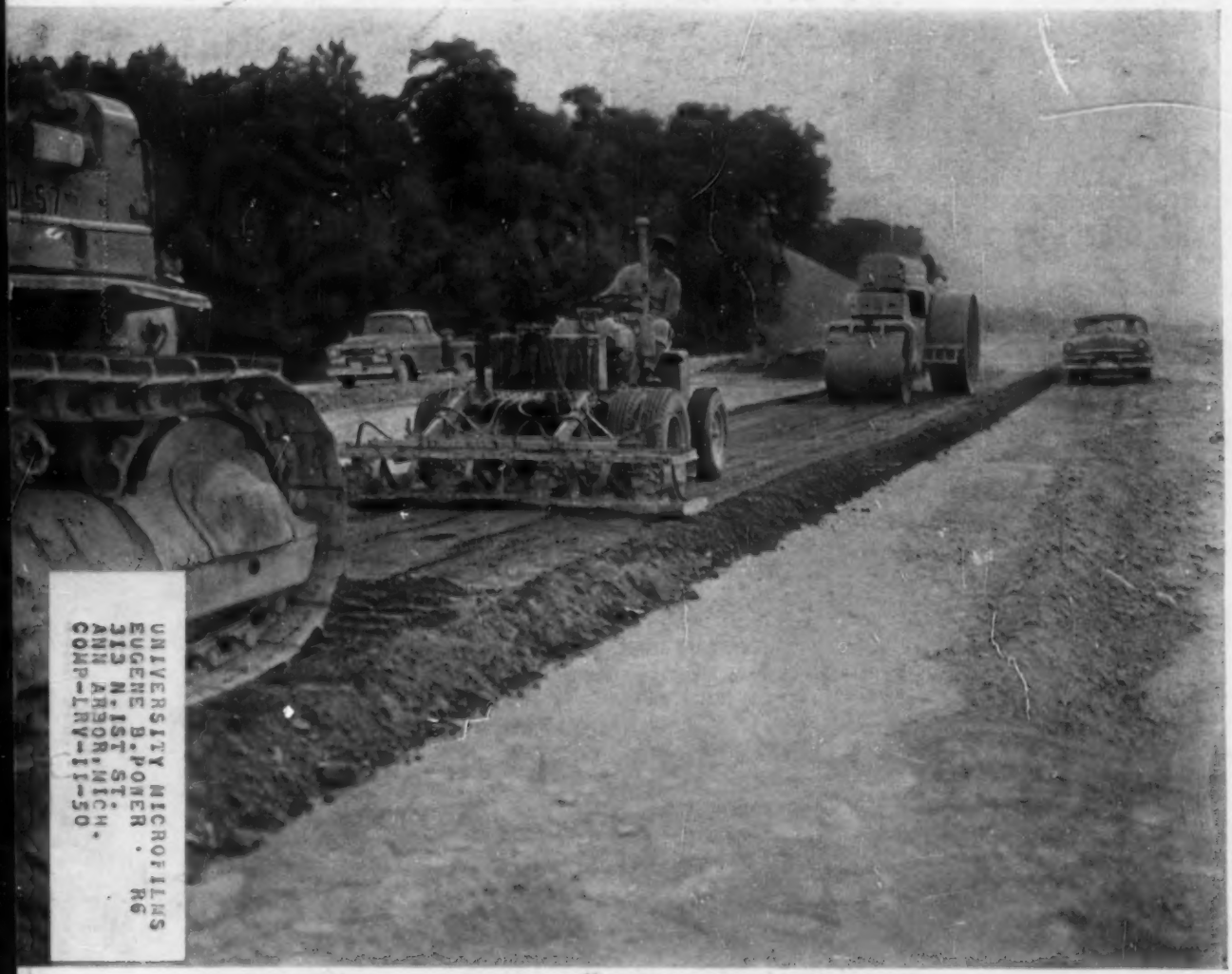
ROADS AND STREETS

January, 1960

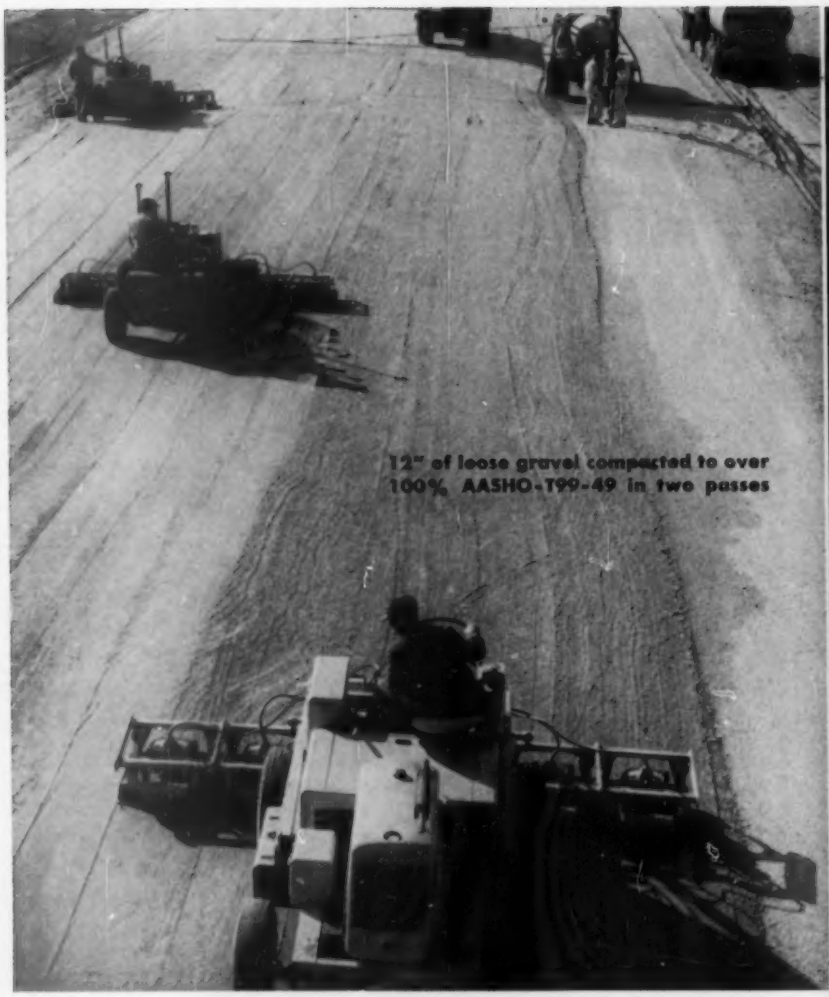
A GILLETTE PUBLICATION



UNIVERSITY MICROFILMS
EUGENE B. POWER . RM
313 N. 1ST. ST.
ANN ARBOR, MICH.
COMP-TRV-11-50

The Fill Specification Problem

pages 62, 73, 108, 116



6 UNITS ABREAST FOR MAXIMUM COVERAGE

6 UNITS IN TANDEM FOR MAXIMUM ONE PASS CONSOLIDATION

4 UNITS (or it might be 5) TO EXACTLY FIT JOB WIDTH REQUIREMENTS

5 UNITS IN TANDEM AND STAGGERED, VARIABLE FOR A WIDE RANGE OF WIDTHS

4 UNITS TOWED AT SIDE OF TRACTOR IDEAL FOR ONE PASS WIDENING OPERATIONS.

SHOULDER COMPACTION* IS AUTOMATIC. End unit automatically assumes this position — no adjustment required. Prevents raveling.

*Attainable with optional equipment.

JACKSON COMPACTORS

MORE OF THEM USED ON AMERICAN TURNPIKE PROJECTS THAN ALL OTHER PAN-TYPE COMPACTORS COMBINED!

The reason is two-fold. 1. The JACKSON, with its tremendously powerful vibratory action, provides 100% of specified density of any material normally used in macadam base or sub-base courses in the shortest possible time. Each unit in the workhead supplies 4200 THREE-TON BLOWS per minute. 2. IT'S FAR MORE VERSATILE THAN ANY OTHER COMPACTOR, ideally adjustable to each and every job requirement. Coverage is what you want it to be, up to 13', 3". Any arrangement of the compactor units, as indicated at right, is quickly attainable. With this machine you can compact areas others can't touch, a factor tha. eliminates lost motion and saves a great deal of time and money. And, of course, it is equally effective on all types of granular soil fills and similar projects. By all means inspect it at your Jackson distributor.

JACKSON TOWED COMPACTOR may be pushed or pulled by any prime mover capable of working speeds as low as 50 FPM; towed to location at any road speed; operated in either direction; controlled by prime mover operator. Two workheads, with as many as 4 units each may be employed, one ahead and one following trailer. Power plant supplies both single and 3-phase 110-115 volt, 60 cycle A.C. and has many uses.

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— name and descriptive literature sent on request.

JACKSON VIBRATORS, INC.
LUDINGTON • MICHIGAN

Galvanized Beam Guard Rail Cuts Maintenance Costs to the Bone

When you specify Bethlehem galvanized beam guard rail, you can count on these advantages:

1. While the cost for erecting is comparable to that of painted rail, the final installed cost is often *less*, due to the elimination of the painting crew.
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4. The electrochemical action of the zinc coating assures continuing protective action even if a portion of the rail is exposed by damage.
5. Galvanized rail will last as long as any competitive material, at lower cost, and at no sacrifice in strength.

For full details, call our nearest district sales office. They'll be glad to give you the full story on Bethlehem galvanized beam guard rail.

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BETHLEHEM STEEL

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ROADS AND STREETS January, 1960
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Accepted as Controlled Circulation Publication at Milwaukee, Wisconsin. Published monthly. Subscription $6.00 per year ($7.00 foreign.) Form 3579 requested to be returned to Gillette Publishing Company 22 W. Maple St., Chicago.

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Goodyear can tell you ways to cut your costs

WHAT YOU'RE UP AGAINST—Problems of terrain, roads, loads, climate, schedules and speeds will be calculated by Goodyear Big-Tire Specialists to determine what your tire needs and costs will be.

They'll advise the best tire and the best buy for each phase of the work—from a complete line of specialized big tires.

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Example: SUPER ROAD LUG

Here's the great "go-anywhere" tire that's designed to keep going strong under the most brutal conditions—still be in good shape long after ordinary tires have quit. With its 50% greater nonskid tread and super-tough, new cut-resisting rubber compounds, SUPER ROAD LUG is built to perform better and far longer than other heavy-duty tires—yet costs no more to start with. Get the whole story from your Goodyear dealer—or write Goodyear, Truck Tire Dept., Akron 16, Ohio.

Road Lug—T M. The Goodyear Tire & Rubber Company, Akron, Ohio

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GOODYEAR

MORE TONS ARE HAULED ON GOODYEAR TRUCK TIRES THAN ON ANY OTHER KIND

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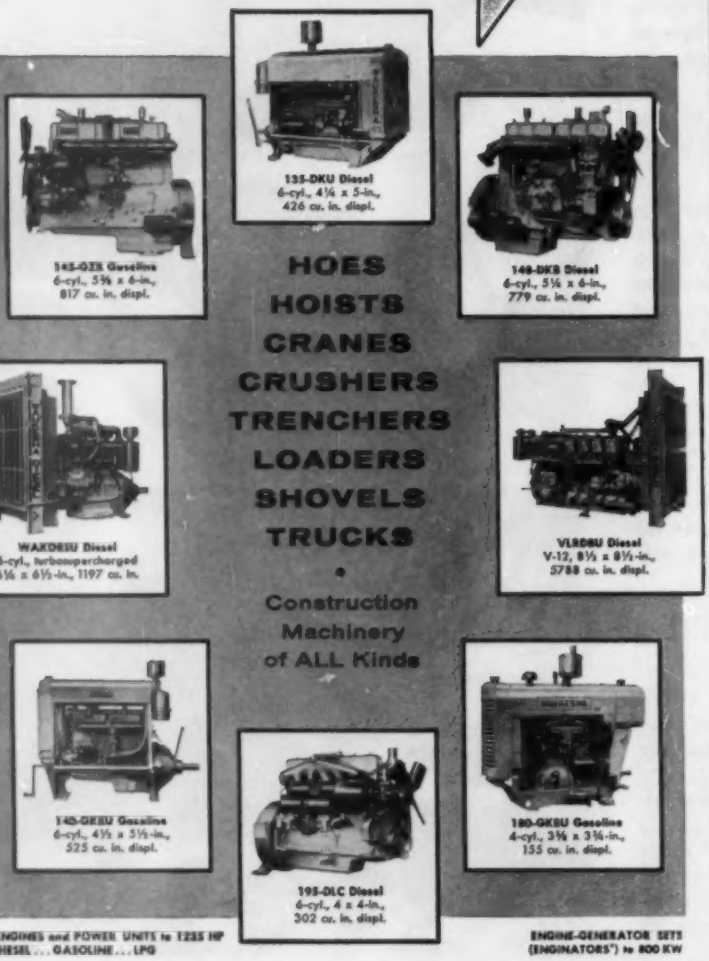

For service—in any country—or any climate—stamina and dependability are *built-in*. Power packed—to pay profits in fast, smooth performance, fuel economy, and low upkeep—Waukeshas are the choice of operators and contractor-owners alike. Find out *why* from your Waukesha distributor.

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Publication and Editorial Offices:
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#1 *Repairing concrete with adhesives that cure* STRONGER THAN CONCRETE

Through extensive laboratory and field tests, concrete adhesives based on THIOKOL liquid polymers have shown outstanding strength in a wide variety of applications . . . bonding both old-to-old and new-to-old concrete.

They have successfully met the challenge of time, temperature and wear in repairing spalled and scaled areas, broken slabs and cracks . . . in securing cement overlays . . . in skidproofing and sealing . . . and in bonding traffic markers to both cement and bituminous concrete surfaces.

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Gentlemen: Please send me available data on THIOKOL LP/Epoxy adhesives for concrete repair.

Firm_____

Street_____

City_____ State_____

Your Name_____

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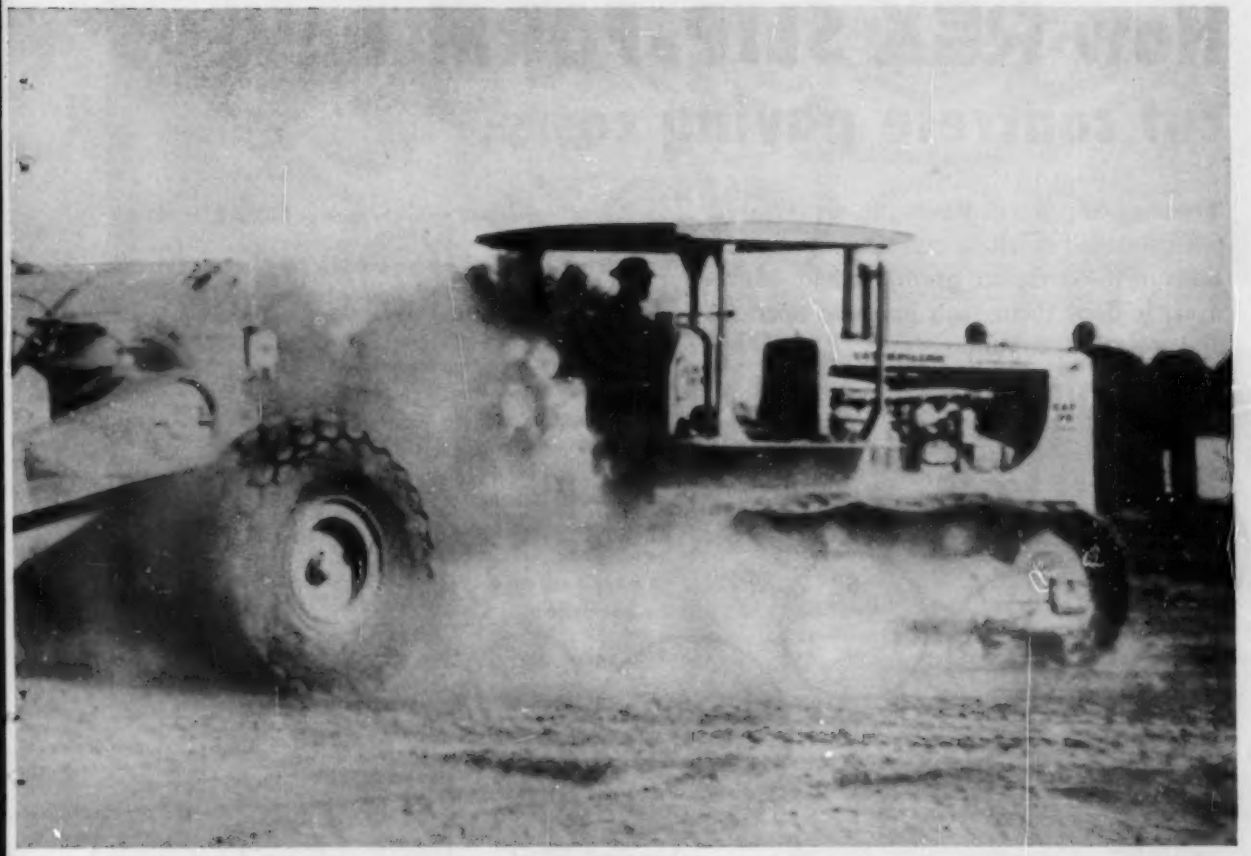
DESPITE 5,000 HOURS
"Texaco Simplified Lube Plan

says J. A. Fulkerson, land leveling contractor of Blythe, California

"This D-8 Caterpillar had run 5,700 hours when new rings were installed," Mr. Fulkerson continues. "When the engine was stripped at 11,130 hours in accordance with Texaco planned maintenance schedule, those rings were still amazingly clean, despite more than 5,000 hours' operation in a dustbowl.

"It's performance like this that has kept me a 100% Texaco customer for the past 15 years.

CLOSE INSPECTION by Mr. Fulkerson (right) and Texaco consignee G. E. Covington proves fine condition of rings and pistons of Caterpillar D-8 engine after 5,430 hours' service in conditions shown in top picture. Mr. Fulkerson has used Texaco 100% since 1944.



IN A DUSTBOWL
kept rings amazingly clean"

And the Texaco Simplified Lubrication Plan makes sure that all my equipment is getting the same kind of systematic servicing that kept this D-8 running so well."

Take a tip from Mr. Fulkerson. Try a Texaco Simplified Lube Plan on your next project. Every Texaco Plan is designed to handle all major lubricating requirements of a particular job with only six lubricants or less. Low inventory like that saves manhours in storage and handling, cuts paperwork in ordering, and minimizes the chance of misapplication of lubricants.

Ask a Texaco Lubrication Engineer to help you streamline your lubrication procedure with a Texaco Simplified Lubrication Plan. Just call the nearest of the more than 2,300 Texaco Distributing Plants, or write Texaco Inc., 135 East 42nd Street, New York 17, N. Y.

Tune In: Texaco Huntley-Brinkley Report, Mon. Through Fri.-NBC-TV

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(PARTS, INVENTORY, PRODUCTION, DOWNTIME, MAINTENANCE)

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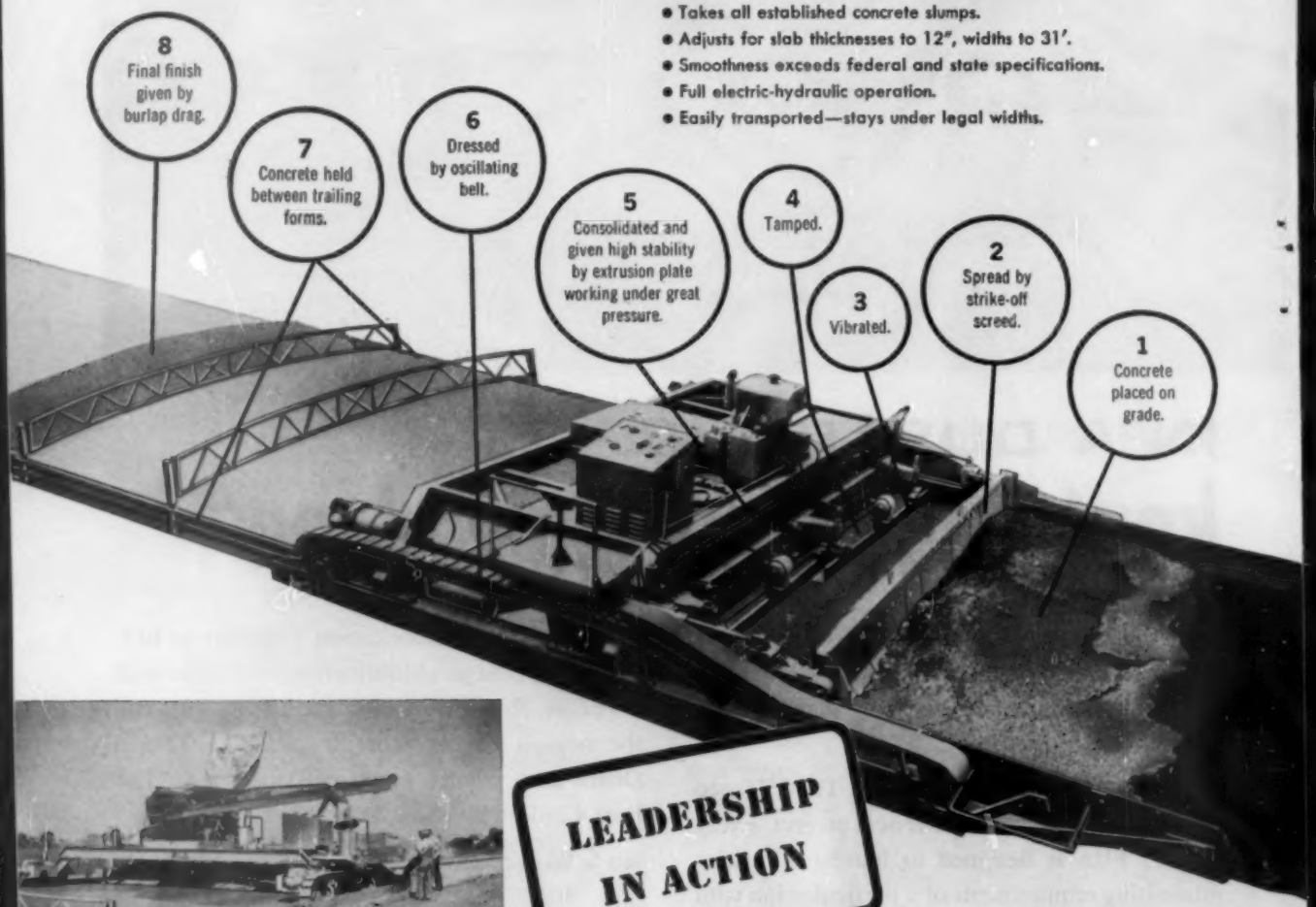
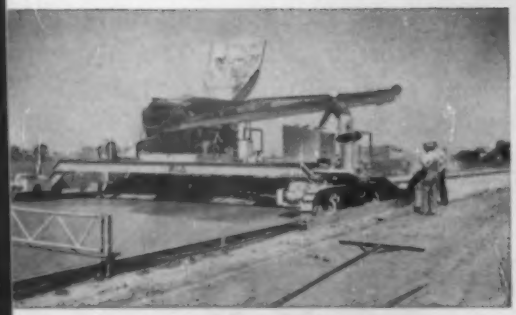
The Rex Slip-Form Paver in *one* versatile, self-propelled machine performs most functions of the complete paving spread. Moreover, it does them with just *one* operator and at a rapid, continuous rate.

- Greatly reduces slab costs—as much as $4000 to $6000 per mile.
- Nearly 1000 miles already paved by Rex Slip-Form Pavers—including federal highways.
- Now approved in many states, with others planning to take advantage of its savings.
- Has worked around the calendar—in all seasons.
- Eliminates forms, setting crews and equipment.
- Ends need for separate spreader and finisher, and operators.
- Places reinforced or non-reinforced slabs.
- Takes all established concrete slumps.
- Adjusts for slab thicknesses to 12", widths to 31'.
- Smoothness exceeds federal and state specifications.
- Full electric-hydraulic operation.
- Easily transported—stays under legal widths.





LEADERSHIP IN ACTION

REX®

CONSTRUCTION MACHINERY

NEW SOUND-COLOR FILM. Road officials and contractors, see the new, educational motion picture giving step-by-step explanation of the Rex Slip-Form Paver! For details and literature, contact your Rex Distributor or write CHAIN Belt Company, 4652 W. Greenfield Ave., Milwaukee 1, Wis. In Canada: CHAIN Belt (Canada) Ltd., 1181 Sheppard Ave. East, Toronto, Ont. Distributors in all principal cities of the world.

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TENNESSEE — construction of farm-to-market road.

GALION® Model 160 MOTOR GRADERS

OHIO — construction of state route 1.

are always doing tough work on important jobs across the country.

They are the most useful units of construction equipment built today—for contractors on new jobs and for states, counties, townships, cities and towns on maintenance and repair work.

These rugged, powerful graders do all types of blading and scarifying work, regardless of location, earth condition, climate or weather.

30,020 pounds of working weight **balanced** to 160 diesel horsepower, with constant mesh transmission, produces the tractive effort that gives you the most push power at the blade ever developed in a grader its size.

Attachments for scarifying, bulldozing, snow-plowing, and an all-weather stand-up height cab are money making and useful attachments for you.

The hydraulic shiftable moldboard, power steering, and hydraulic fingertip controls for all operations are standard equipment.

Write today for complete specification literature.

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ARIZONA — bank-cutting on construction of state route 93.

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Please send me complete information on the Galion Model 160 Motor Grader.
Name_____ Title_____
Firm or Dept. _____
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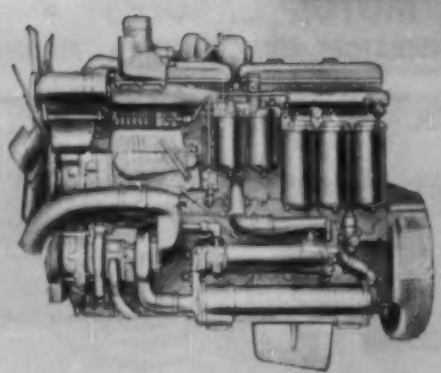
Keep full loads on the move full time with exclusive Planet Power-steering. Full power on both tracks, *full time*, is the answer! And Hi-Lo on-the-go power-shifting lets you match power to condition, instantly, and keep the yard-boosting advantage of uninterrupted momentum.

You speed-up all four steps of the push-loading cycle with TD-25 torque-converter and planetary system teamwork! 1) You slow down by power-shifting down and using decelerator to get feather-touch contact; 2) power-shift either track up or down to maintain solid pusher contact on curves; 3) get gear-higher kick-outs, with on-the-go power-shifting; 4) reposition faster, with higher-than-ordinary reverse! Two "25s" tandem-pushing the International 295 Payscraper®, and the third, scarifying, belong to contractor Ed Bentley, Sylacauga, Alabama — building superhighway near Birmingham.

PLANET Power-steering... HI-LO power-shifting... COME AS standard equipment ONLY in the new TD-25



The International DT-817 engine—single power source used in both *pushers* and *scrapers*—an *industry first* in power standardization. You'll find this big new direct-start, 6-cylinder turbocharged diesel powering the full line of International two and three-axle Payscrapers; Paywagons®; and end-dump Payhaulers.® *Plus* the new TD-25I Dual valving of this high-torque, 230-hp power plant provides for peak turbocharging efficiency, to develop full power from sea level to timberline!

As standard equipment at no extra cost, the new 230-hp TD-25 gives you the International®-proven control combination that has been beating king-sized clutch-steered crawlers in yardage for years!

You get combined Planet Power-steering and Hi-Lo on-the-go, power-shifting exclusively in the new International TD-25. And you get this basic, built-in design advantage in your choice of torque-converter or synchromesh model!

With this and all its other big advantages, the TD-25 can outearn other big rigs up to 50%—on push-loading; and pulling big drawbar tools such as shale-shattering scarifiers!

No "dead-track drag" or "gear-shift lag"! Planet Power-steering gives you full-time "live" power and traction on both tracks, to make full-load turns—and to eliminate load-limiting "dead-track drag." And Hi-Lo on-the-go power-shifting instantly matches power to conditions to prevent load-losing "gear-shift lag."

Hi-Lo power-shifting makes the TD-25 the industry's only 4-speed torque-converter crawler and the only one with load-matching efficiency-range control. In the synchromesh transmission "25," the Hi-Lo planetary system gives eight speeds forward and reverse—with cycle-speeding, up-or-down, on-the-go power-shifting with "finger-tip" ease!

Power-shift and power-steer the new "25" with full king-size loads—around curves, upgrade, anywhere. Prove what it means to command full-time, full-load ability to outearn clutch-steered king-sized crawlers, up to 50%. Measure all the "25's" standard equipment extra value features! See your International Construction Equipment Distributor for a demonstration!

International®
Construction
Equipment

A COMPLETE POWER PACKAGE: Crawler and Wheel Tractors... Self-Propelled Scrapers and Bottom-Dump Wagons... Crawler and Rubber-Tired Loaders... Off-Highway Haulers... Diesel and Carbureted Engines... Motor Trucks... Farm Tractors and Equipment.

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UNIT GIVES YOU THE WIDEST CHOICE OF CAPACITY, PRICE AND VERSATILITY TO MEET YOUR EXACT NEEDS

You can't do today's highly competitive jobs with obsolete equipment and stay in business. You need equipment that enables you to bid low enough to get the job—and efficient enough to turn your low bid into a profit.

The modern Unit line of excavators and cranes gives you bigger EARNING POWER because they are bigger producers on any job—faster cycling, easier operating—plus the built-in rugged dependability that keeps them on the job hour after hour, with negligible maintenance expense.

No other machines in their class perform like a UNIT, because none are built like a UNIT. No one else offers you a one-piece cast gear case with all gears, shafts and bearings operating in an oil bath; automatic traction brakes; straight-in-line engine torque converter drive; all disc type operating clutches; the liberal use of drop forged parts; heat treating on all essential components; full vision operator's cab — a combination of features you don't find even on the highest priced machines.

You'll find a UNIT is worth more when you buy it—and worth more when you sell or trade. Before you buy another excavator, compare UNIT—you'll be glad you did. Write for literature on the models shown or see your nearby UNIT distributor.

CRAWLER SHOVELS
5 CONVERTIBLE MODELS

A rugged line of power-packed machines, designed for today's competitive bidding. Fast operating, simple in design and fully convertible for maximum versatility.

Model	Shovel	Hoe	Dragline	Crane	Clamshell
513C	½ Yd.	½ Yd.	½ Yd.	5½ Ton	½ Yd.
614	½ Yd.	½ Yd.	½ Yd.	8 Ton*	½ Yd.
617	⅝ Yd.	⅝ Yd.	⅝ Yd.	10 Ton*	⅝ Yd.
1020	¾ Yd.	¾ Yd.	¾ Yd.	12½ Ton*	¾ Yd.
1220	¾ Yd.	¾ Yd.	¾ Yd.	16 Ton*	¾ Yd.

*Maximum Crane Capacity.

TRUCK CRANES
4 CONVERTIBLE MODELS

Select the size to fit your needs — all with finest engineering and exclusive quality features. Mounted on rugged carriers for dependable performance on the job and between jobs.

Model	Crane	Shovel	Hoe	Dragline	Clamshell
513T	10 Ton	½ Yd.	½ Yd.	½ Yd.	½ Yd.
1014	15 Ton	⅝ Yd.	⅝ Yd.	⅝ Yd.	⅝ Yd.
1520T	20 Ton	¾ Yd.	¾ Yd.	¾ Yd.	¾ Yd.
360T	30-40 Ton	.....	.....	.....	.....

MOBILE CRANES
2 CONVERTIBLE MODELS

Self-propelled, one man controlled and operated, for on or off highway use. Big capacities, short turning radii. Convertible for greater versatility.

Model	Crane	Dragline	Shovel	Hoe	Clamshell
357	15 Ton	½ Yd.	½ Yd.	½ Yd.	½ Yd.
1520	20 Ton	¾ Yd.	.....	.....	¾ Yd.

UNIT

CRANE AND SHOVEL CORP.

Milwaukee, Wisconsin

UNIT CRANE AND SHOVEL CORP.
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Please send complete information on the following

Unit machines. Model..... Attachment.....

Name..... Title.....

Company.....

Address.....

City..... State.....

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that will put you out front for the BIG JOBS in the 60's

BIGGER · HEAVIER · STRONGER

ECONOMICAL TO OPERATE AND MAINTAIN · CONSTANT MESH TRANSMISSION

NEW MODELS	8-D	9-D	10-D	11-D
HORSEPOWER	83	100	125	160

PEAK PERFORMANCE AND ECONOMY FEATURES THAT PUT THESE MODELS OUT FRONT!

see Huber-Warco for the finest in grading and rolling equipment

HUBER-WARCO COMPANY

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Single member frame designed to absorb heaviest shocks and strains. High arch design improves visibility, provides more room to maneuver blade.

Ruggedly built circle with three big wearing shoes. Designed to protect gear teeth from all loads except turning force.

Circle turn completely gear driven.

Weight where it counts. Two-thirds of machine weight on drive wheels.

Easy, positive steering with hydraulic booster activated by six pounds' hand pressure.

90-degree blade control on either side without leaving cab.

360-degree blade rotation without removing scarifier teeth.

Power sliding moldboard, optional, for faster work around abutments, stakes, and other obstructions.

Full-floating rear axle carries no machine weight.

Large, roomy deck with all controls within easy reach.

Deluxe cab, optional, has 18% more glass for greater visibility.

Six speeds forward and reverse; optional creeper gear adds three more speeds in each direction.

Moving one lever changes direction in same gear.

Other constant mesh transmission features include (1) easy shifting, including range shift, at all speeds (2) shift rails interlocked to prevent multiple engagement (3) pressure flood lubrication (4) ball and tapered roller bearings throughout transmission and final drive (5) helical transmission gears for quiet operation (6) machine-cut, case-hardened alloy steel transmission shafts and gears.

MARION, OHIO
U. S. A.

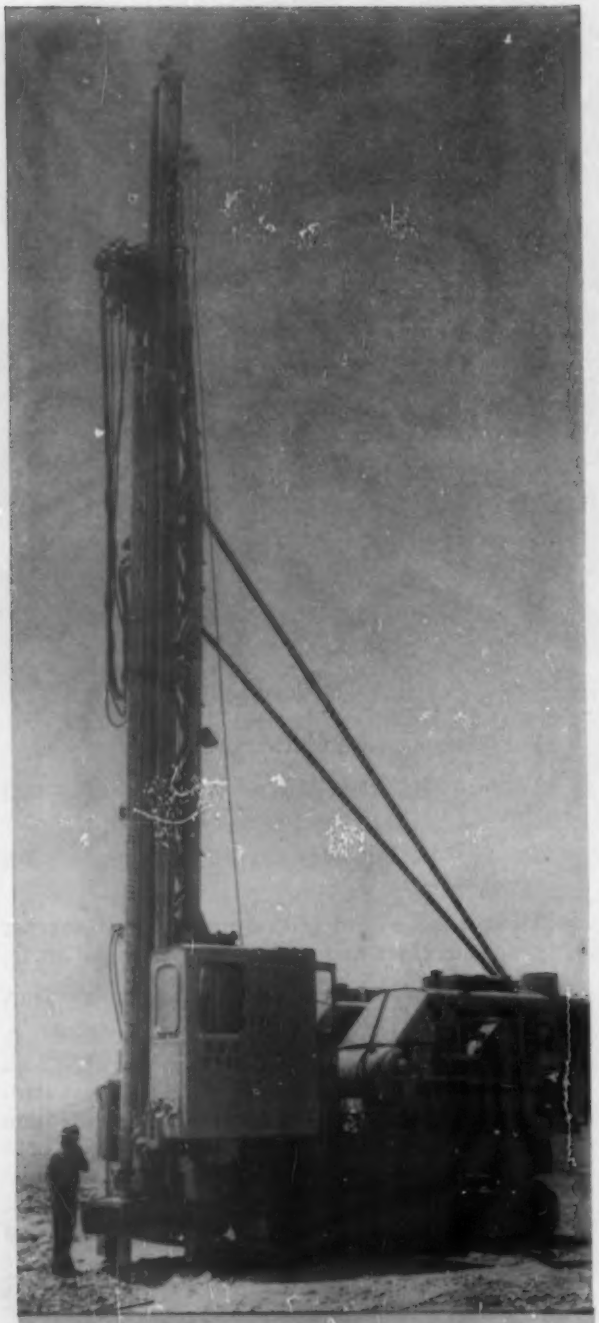
HUBER
WARCO

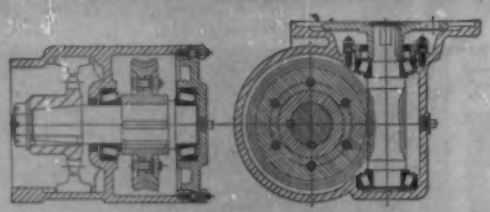
TANDEM ROLLERS

MOTOR GRADERS

MAINTAINER

3 WHEEL ROLLERS





How Timken bearings are used on the worm drive in Ingersoll-Rand's QM-3-DHD-400 "Quarrymaster" —to take heaviest loads, cut maintenance.

How Ingersoll-Rand assures accuracy of "Quarrymaster's" drill feed under 900-blow-per-minute drilling

STRIKING 900 blows per minute and drilling through all kinds of hard broken rock formations puts terrific loads on the air motor that feeds the "Quarrymaster" drill. Yet the motor assures accurate, positive control of drill feed; fights a tight steel when drilling broken and seamy ground. One big reason the motor works so dependably is that the worm gear is mounted on Timken® tapered roller bearings. Ingersoll-Rand selected Timken bearings because . . .

1. *They take all loads.* The tapered design of Timken bearings enables them to take *any* combination of radial and thrust loads. And full line contact between rollers and races gives Timken bearings *extra* load-carrying capacity—to take heavy shock loads.

2. *They reduce maintenance, last longer.* Because they hold shafts concentric with their housings, Timken bearings make closures more effective in keeping dirt and moisture out, lubricant in, maintenance down. Bearings and parts last longer.

And Timken bearing-equipped machines give you the extra advantages of Timken Company leadership in tapered roller bearing design plus service from graduate engineer salesmen. Backing this leadership are the most modern testing, research and development facilities in the bearing industry.

When you buy Timken bearings you get . . . 1) Quality you can take for granted. 2) Service you can't get anywhere else. 3) The best-known name in bearings. 4) The pace setter in lower bearing costs. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable: "TIMROSCO". *Makers of Tapered Roller Bearings, Fine Alloy Steels and Removable Rock Bits.*

BETTER-NESS rolls on

TIMKEN®

tapered roller bearings

. . . for more details circle 343 on enclosed return postal card

ROADS AND STREETS
Sixty-Six Years of Editorial Leadership

Washington News Letter

By Duane L. Cronk, Director, Highway Information Services, Inc.

January 10, 1960

Highways are costing too much in three eastern states, a federal auditing agency has found. In a special report to Congress, the Government Accounting Office claims that roads are more expensive than they should be in Maryland, Pennsylvania, and West Virginia - for a variety of reasons, mostly legal and administrative. Restrictions hampering right-of-way acquisition, for example, are substantially increasing the cost of land and causing delays in the road program. Also, costs have become inflated in these three states, the GAO maintains, because of the failure of the departments to gear up their engineering and planning departments.

The agency also believes that inadequate notice on invitations for bids is a weakness in West Virginia, that Maryland is illegally using convict labor on secondary road construction, and that Pennsylvania is handicapped by laws which require county approval of right-of-way takings. There is reason to believe similar problems are holding up construction in other states, the GAO concluded.

* * *

Senator Harry Byrd blasted the Administration last month for letting the National Highway Program fall into "an inexcusable mess." The chairman of the powerful Senate Finance Committee declared that highway needs should be met as they develop - and, of course, on a pay-as-you-go basis. Otherwise, billions of dollars are expended on designs which are obsolete almost by the time they are completed and the cost of the money borrowed to build them eats into the availability of future funds. Crash programs are costly, also, he said, because they encourage loose administrative practices. He urged a rejection of the 90-10 matching formula for the Interstate System and a return to the traditional 50-50 scheme.

Rumor is that the Administration will ask another ½¢ boost in the federal gasoline tax this month, and already the opposition has begun to crackle. Federal officials say they must have the new money to keep the accelerated road program on the move. The American Automobile Association, the truckers and others have responded aggressively. Warning that they will present a united front in opposition to any further gasoline tax increase, the AAA called the proposal "unconscionable and unjustified." Tampering with the existing tax structure before the BPR studies are completed in 1961 would be premature, the users maintain.

* * *

There will be another Road Show in 1963. The Construction Industry Manufacturers Association has announced that a poll of the equipment makers indicates solid support for a repeat of the big event. The 1957 Show in Chicago drew 70,000 contractors and engineers from 56 different countries. Hailed as the largest industrial exhibit of

(continued on next page)

any kind ever held under one roof, the Road Show cost its promoters an estimated $9 million to stage.

More than $300 million in state highway user taxes was "diverted" in 1958 to non-highway use, the National Highway Users Conference has reported. And a conference of state officials has seriously considered passing a resolution demanding that the federal government's practice of collecting some highway user taxes for the general fund be condemned.

The NHUC report revealed that $5 billion in state highway funds has been diverted since 1934. The $303 million of such revenue used for other than highway system development in 1958 was 6½ percent of the total highway receipts. NHUC is pushing for constitutional amendments which would earmark highway taxes for road improvements.

A conclave of state officials meeting under the sponsorship of the Governors' Conference and the Council on State Governments debated, but refused to adopt, a resolution which would require that all of the federal highway user taxes be dedicated to financing the National Highway Program. Declaring that such a proposal runs counter to their own state fiscal policies, a majority of the delegates turned "thumbs down" on the resolution. New Jersey's Salvatore Bontempo argued that if the principle of earmarking highway tax revenues for highway improvements were valid, then "we should be spending our inheritance tax revenues on beautification of our cemeteries and our alcoholic beverage taxes on rehabilitation of alcoholics."

* * *

Roadbuilding costs are still riding a level rail. The BPR price index, reflecting costs of excavation, surfacing and structures on all federal-aid jobs, rose only 2/10th of 1 percent during the third quarter of 1958. Excavation was up 3.5 percent and structural concrete, 4.1 percent; but surfacing dropped 2.2 percent.

There is considerable more paving work in the Federal-Aid Airport Program for fiscal 1960, announced recently by the Federal Aviation Agency. Although the money provided is about the same as for the last fiscal year - $63 million, plus matching on a 50-50 basis - more of the new money will go into runways and taxiways. This is in line with the Administration's wish that the federal money be spent for actual airfield construction, rather than on terminal buildings, parking lots and other allied facilities. Of the total 288 airport construction projects approved by the FAA for this fiscal year, 38 percent will go for runway work and another 34 percent for taxiways.

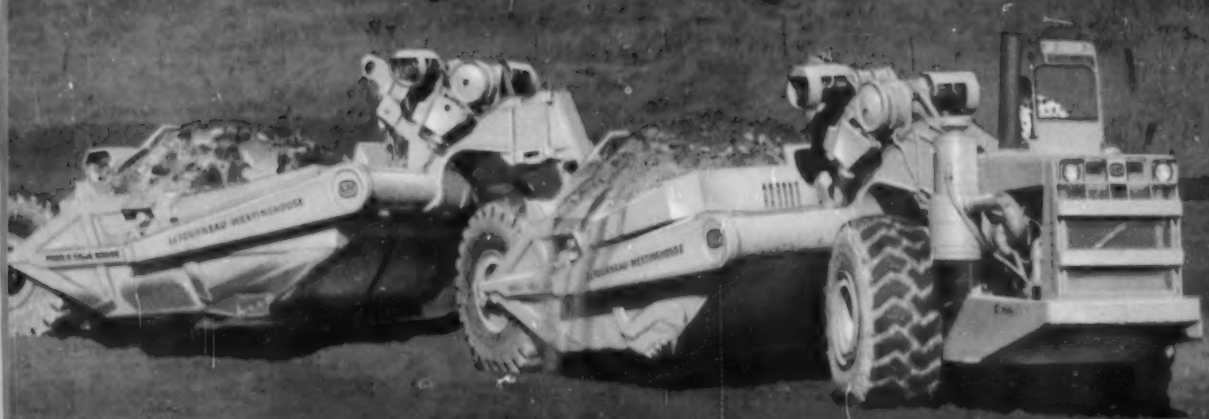
* * *

Highway policy debate drew some of the strongest statements of the year from municipal interests attending the American Municipal Association convention held recently in Denver. Among other things, the mayors called for creation of a new federal-aid urban system of arterial streets, to become the recipient of substantially increased federal aid. The new system would be in addition to federal-aid Primary and Interstate Systems in urban areas, but would include extensions of the federal-aid Secondary System, lateral, feeder, distributor and such circumferential routes as may be required to furnish maximum utility to the various federal-aid systems within or adjacent to urban areas.

Uncle Sam should come to the aid of commuter railroads, also, and help to rehabilitate them so they can carry more of the traffic and thus relieve part of the load on urban expressways, the mayors said. Federal loans should be made available to municipalities or private companies to enable them to purchase new equipment and improve their facilities, they advocated.

NOW

You haul TWO LOADS every trip



LeTOURNEAU WESTINGHOUSE

LW

TANDEMS

TWO LOADS every trip...with LW TANDEM SCRAPERS

You save on investment: You double your load-capacity, but pay only for a second scraper and incidental hitch and installation. You save the price of a second prime-mover!

You save on operation: Your only additional operating cost for double-capacity LW Tandems is for a little more fuel per shift. One operator handles both scrapers!

You save on maintenance: Upkeep is only pennies-per-hour more than for a single scraper. You have six tires in place of four, but there is only one engine, one transmission, one final drive to care for.

This C-Tandem packs in 36 yards in 40 to 55 seconds for a California Contractor

This 270-hp C Tournapull® with tandem 18-yd C Fullpak® scrapers, moved an average of *36 yards per cycle* on a grading project at Pinole, California, for San Francisco Contractor Al Periera. With a 191-hp pusher, load times (to fill both scrapers with 18 yd each) averaged from 40 to 55 seconds.

Periera's C-Tandem kept pace with a single scraper C 'Pull* on the same job, negotiated 18% grades and averaged about 13 more gallons of fuel per shift than the single "C". It performed every standard maneuver, including full U-turns and full back-ups, with no tendency to jack-knife.

*Trademark

You need less pusher-power:

In LW Tandem operation, your pusher loads only one scraper at a time, so there's no need for a "super" pusher or for tandem pushers. You save *time*, too, because *one* tractor loads *two* scrapers in line . . . no time lost for repositioning.

Your haul roads last longer:

LW Tandems are no higher, and no wider, than single 'Pulls. They can use any haul road. With Tandem scrapers you use *fewer* machines, have less traffic congestion and delay. And ton-for-ton, there is less pounding of haul roads with Tandems than with single scrapers of equal capacity.

You get more adaptability:

You can meet changing job conditions by hitching or unhitching the Tandem scraper at will. And you can still interchange your basic scraper for a Rear-Dump, or other LW attachments, to spread your prime-mover investment over more jobs.

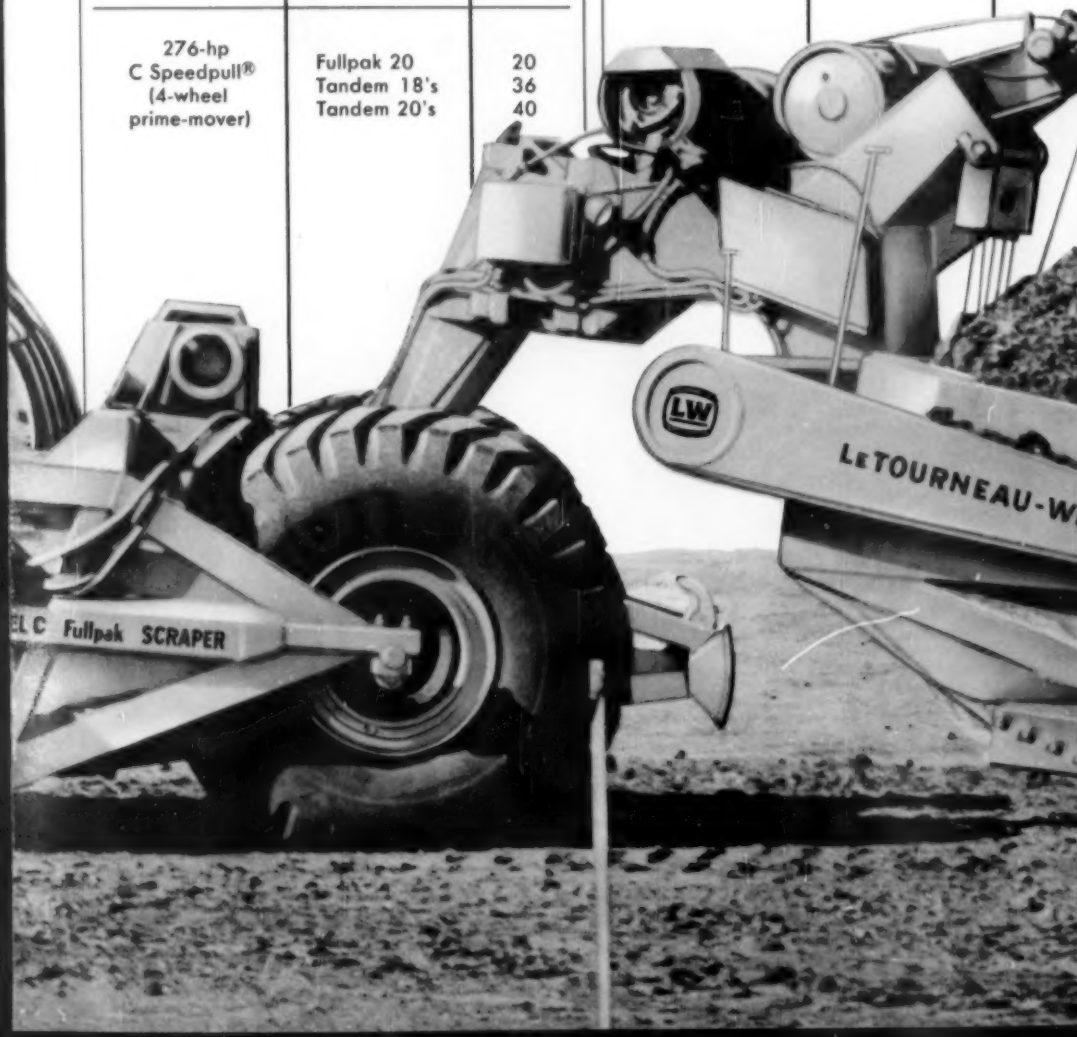
Use Tandem scrapers behind any 'Pull:

Choose from 9 to 56 cu yd capacit

You can pull and operate two scrapers with *any* LW electric-control 'P prime-mover. Here are *some* of the LW scraper combinations now availa to move dirt at a *new* low in cost-per-yard:

PRIME-MOVERS	SCRAPERS	TOTAL HEAPED YARDS
143-hp D Tournapull	Model D Tandem D's	9 18
226-hp C Tournapull	Fullpak 18 Tandem D's	18 18
270-hp V-Power C Tournapull	Fullpak 20 Tandem 18's Tandem 20's	20 36 40
276-hp C Speedpull® (4-wheel prime-mover)	Fullpak 20 Tandem 18's Tandem 20's	20 36 40

PRIME-MOVERS	SCRAPERS	TOTAL HEAPED YARDS
335-hp B Tournapull	B Fullpak Tandem 18's Tandem 20's	28 36 40
360-hp B Tournapull	B Fullpak Tandem 18's Tandem 20's Tandem B's	28 36 40 56

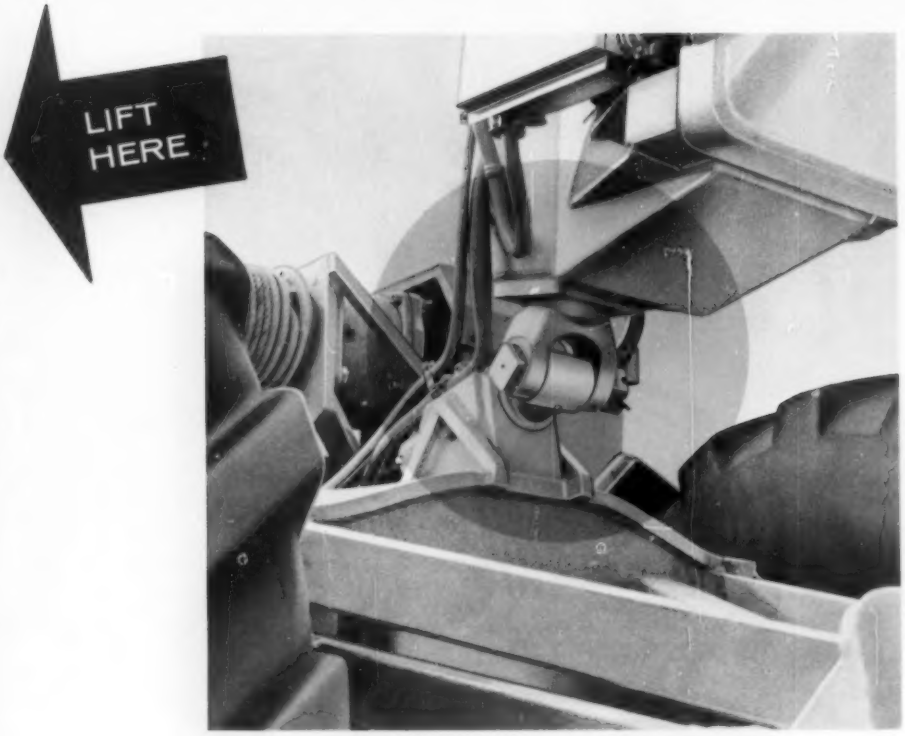


Where LW Tandems pay off best

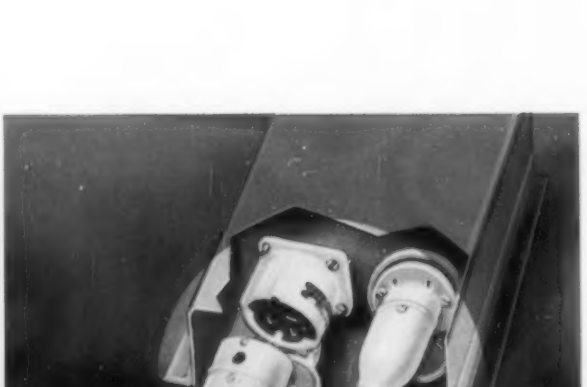
1. *Use LW Tandems* where the combined rolling and grade resistance of haul roads is 60 lb per ton or less on the loaded haul, or 120 lb per ton maximum on return routes.
2. *Use LW Tandems* on short hauls where you cannot take full advantage of single scraper speed.
3. *Use LW Tandems* in tough loading. Where your present pusher may not be able to load a 28-yard scraper, for example, it can *easily* load two 20-yard scrapers *in tandem.*

In general, use LW Tandems wherever and whenever you do not NEED, or cannot take ADVANTAGE of, the full power and speed of single scrapers. You will find that many of your jobs fit that description . . . where LW TANDEMS PAY OFF BIG!

Your LW Distributor can convert your *present* 'Pulls to tandem operation, or equip you with new, 1960 'Pulls with tandem connections already installed. He can also give you reliable engineering data that will show you on what job conditions you'll make *most* money with LW Tandems. He can show you full-color motion pictures of LW Tandems at work on jobs very similar to *yours.* You can see for yourself how these revolutionary LW Tandems can increase your profits. See your LW Distributor *soon.*



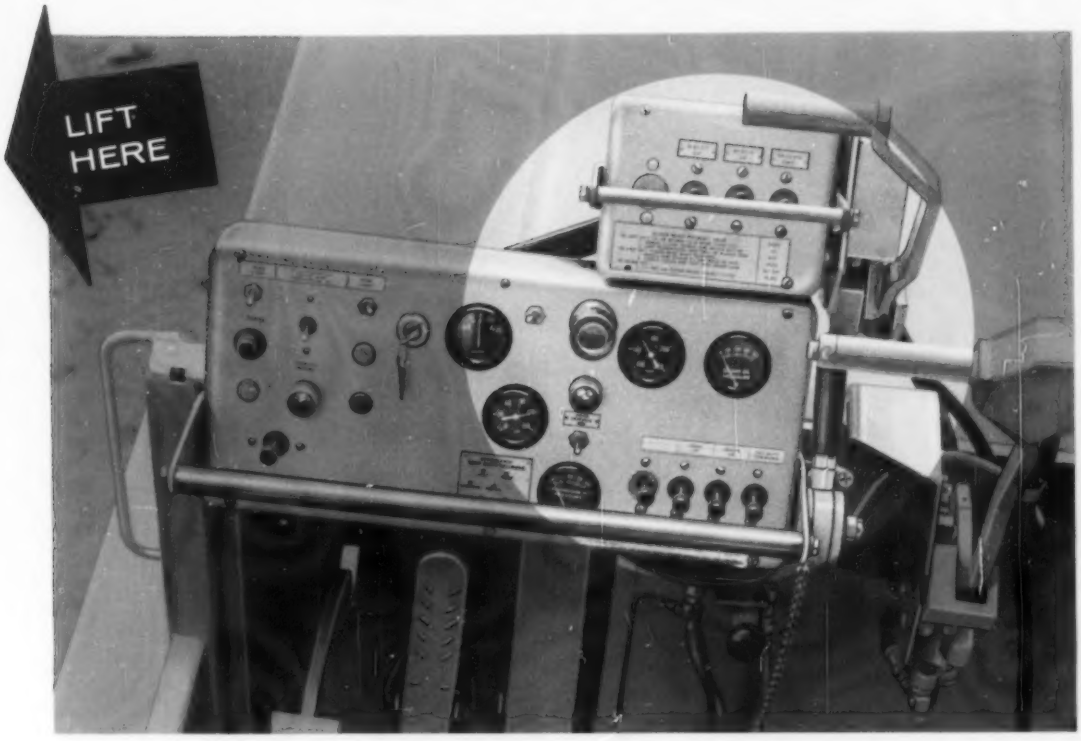
LW Tandem Hitch...big, simple, rugged
permits single-scraper maneuverabilit



This universal-swivel hitch secur
connects the front scraper to
rear scraper in LW Tandems. T
plate and hitch are welded to
members of the push-block frame
the front scraper, which are re
forced with high-strength steel ch
nels. Its pivot-point is over the re
axle of the front scraper. Elect
and air lines "plug in" to simp
quick disconnects at the hitch.

This hook-up of scrapers is so s
ple that, once installed, you can
the extra scraper or take it off
less than half an hour.

The tandem hitch permits compl
maneuverability. You can back
turn in any direction, and perfo
any other maneuver that is possi
with single scrapers. And there
never a tendency to jack-knife! I
tandem turns are made in an a
only 20 to 25% wider than is requi
for single self-propelled scraper



LW ELECTRIC CONTROL

provides the means for practical tandems

This is the control panel of a 'Pull Tandem. Its fingertip buttons control bowl-lift, apron, and tailgate... bottom row for the front scraper, top row for the rear scraper. By the simple action of moving a button, a circuit closes and transmits electric work-power instantly along flexible copper wires, to the desired control motor at point-of-action.

It is this unique 'Pull feature that makes possible the practical operation of a second scraper. Unlike mechanical or hydraulic power, electricity can be sent any distance, in any direction, along small-diameter, flexible wires. The power so transmitted arrives at its point-of-work in a split-second. No extra power source is needed.

Making tandem operation *practical* is only one of the remarkable advantages of LW "electrics." It gives immediate response — in 3/5ths of a second. It is easiest to operate — your operator merely moves buttons! It is completely weatherproof. No other control system can be maintained at full efficiency for less money and with less attention.

For most profitable use of 'Pull Tandems, maintain job-sites with fast LW "work-tools"

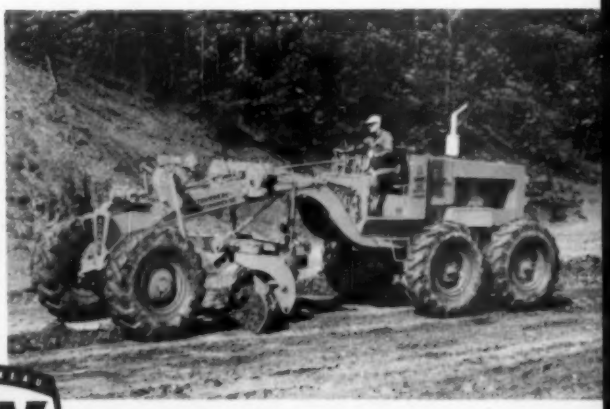
With the tremendous pay-loads you can pack into LW Tandems, you'll want more than ever to keep your haul-roads, cuts, and fills well-maintained. You'll handle this important job easiest and at least cost with these fast-working LW machines:

C TOURNATRACTOR®:

Use it to speed haul-road construction, cut-and-fill maintenance, and dozens of other tractor jobs all over your spread. With 17-mph speed and instant-shift, Tournatractor *gets* to a job faster, *works* faster. And you can use its 218 hp to push-load scrapers, *even Tandem C's!* Popular on big jobs for towing sheepsfoot rollers.

LW MOTOR GRADER:

Fastest grader built, with 26.7 mph top speed, and higher working speeds gear-for-gear than any other make. One-piece frame for extreme ruggedness; big 63″ circle, for accurate blade control; full view visibility, so operator can see both ends of blade as well as the road ahead. Seven models, to 190 hp, including two POWER-*Flow*® models with torque converters. Standard models offer 8 forward speeds, 4 reverse and 3 optional creeper gears.



Set a New Standard for the Sixties with LW SPEED Equipment

Now is the time to check with your LW Distributor. He can give you full details on the revolutionary new LW Tandems, and will be proud to show you the full line of LW *SPEED* earthmoving equipment for 1960. Every machine in the line is as fast or faster than any similar piece of equipment on the market. LeTourneau-Westinghouse long ago mastered *quality* and *dependability*. Its leadership in these values is an accepted fact all over the world. And now LW has added a new standard of SPEED and CAPACITY in earthmoving equipment, because in today's era of tight profit-margins, only by moving more dirt in less time can you achieve *lowest-net-cost-per-yard* and its resulting profits.

Only LW offers you proven equipment in all four basic types of rubber-tired earthmoving machines: scrapers, tractors, graders, and off-highway trucks. See your LW Distributor SOON!

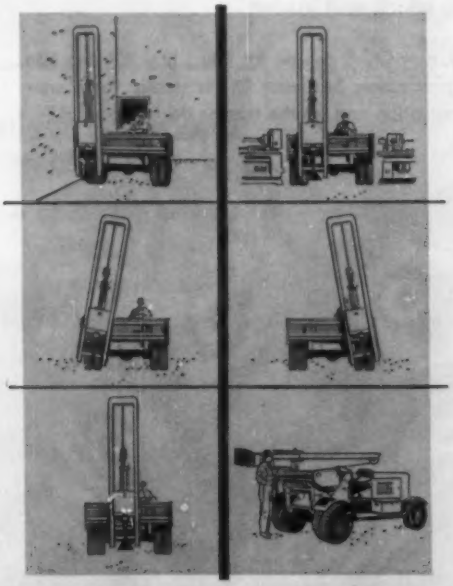
LeTOURNEAU-WESTINGHOUSE COMPANY
PEORIA, ILLINOIS
A Subsidiary of Westinghouse Air Brake Company
Where quality is a habit

Litho in U.S.A.

TP-2260-DC-8

Arrow side-action hydraulic hammer

New Arrow model works across width of 8′



Here is a new Arrow—Model A-130-AS—that gives you all of the money-saving features of the standard Arrow PLUS the advantages of Side-Action. Extensive field testing has proved the new Arrow to be an even greater money-maker for contractors.

With the new Side-Action Arrow, you can tamp or hammer a distance of 7 feet from one side to the other straight across the front of the machine—8 feet by angling the hammer leads. You can work close to a building or other obstructions—cutting asphalt, breaking concrete, tamping backfill or driving stakes or piling. You can work from side to side or in a straight line forward or backward—as with a standard Arrow—or you can use any combination of these actions that will best do the job.

At the touch of a control, you can shift the hammer rapidly from side to side, stopping it wherever you wish. You can set the hammer stroke control on automatic to deliver blows of uniform impact at a uniform rate—or you can control the hammer manually. Other controls tilt the tower forward or backward or at an angle, or fold it back, reducing machine height to 6′2″ for going through doorways or for highway travel.

For complete information about the new Arrow Model and its money-making features, WRITE TODAY.

ARROW DENVER

ARROW MANUFACTURING COMPANY

194 W. Dakota Ave., Denver 9, Colorado

. . . for more details circle 279 on enclosed return postal card

ALL NEW OLIVER OC-9

the tractor that TALKS for itself!

with TRANS-O-MATIC drive

Check all these exciting new features in an on-the-job demonstration!

NEW! Counter-rotating tracks
OC-9 turns on its own axis! Shortest turn of any crawler. Gets in and out of tight spots fast. Exclusive with Oliver on this size tractor. Also, spot turns and gradual turns.

NEW! Torque converter
Pull or push twice the pay loads at slow speeds. Eliminates all clutching and gearshift guessing. Uses most effective horsepower.

NEW! Power shifting
Shift from forward to reverse instantly. No clutching, no clashing of gears with all-hydraulic transmission. Four speeds forward, 0 to 5.94 m.p.h. Four speeds backward, 0 to 7.92 m.p.h.

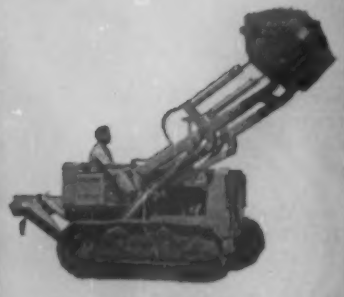
NEW! More efficient power
Get more work done more economically. New diesel engine with 62 gross h.p. plus new torque converter, gives you exceptional power efficiency.

NEW! Functional design
Truly modern from end to end, from the ground up. Easy-handling, finger-tip controls, with convenient power steering. Seat is offset for greater visibility. Oliver-matched equipment includes bull-dozer, angledozer, scarifier, winch and loader.

See for yourself what the husky, new OC-9 can do for you...how it'll step into those tough jobs and step up production. See your Oliver dealer for a convincing give-it-the-works demonstration and let the tractor do the talking!

All New OC-96 Crawler Loader

with low-profile design, greatest stability, maximum visibility. Completely Oliver-designed for high-speed digging and loading work. One-yard bucket. Has all the other features of the new Trans-O-Matic OC-9.



OLIVER

THE OLIVER CORPORATION
Dept. 2232, 400 W. Madison St., Chicago 6, Ill.

LOOK TO OLIVER FOR YOUR BEST BUY IN WHEEL AND CRAWLER TRACTORS

Euclid "TWINS" give you a better return on investment

Twin-Power all-wheel drive scrapers get more work done and move the cheapest dirt on every kind of job.

Only the EUCLID TS-24 SCRAPER has all these features:

2 engines—563 total h.p.
All-wheel drive
One-man operation
32 yd. heaped capacity (24 yds. struck)
2 Torqmatic Drives
NoSpin differentials
27.00 x 33 tires (33.5 x 33 optional)

The Euclid TS-24 Scraper can help you beat the squeeze on profits because it's the most versatile and most productive scraper in the field. Two engines, each driving an axle through separate torque converters and semi-automatic transmissions, provide maximum usable horsepower at all times. The "Twin" can self-load and move big loads out of soft or sandy borrow pits and over steep grades. With "no clutch" Torqmatic Drives, NoSpin differentials, and fast-acting, independent hydraulic controls, the TS-24 is easy to operate and has unequalled maneuverability.

Performance records from a wide range of work . . . from small jobs where one or two scrapers must handle all the earthmoving without supplementary equipment . . . to big yardage projects where the "Twin" is teamed with the Euclid TC-12 Crawler for high speed production . . . show that the TS-24 provides a big cost advantage.

The Euclid dealer in your area will be glad to give you details on the complete line and show you why ***Euclids are your best investment.***

EUCLID Division of General Motors, Cleveland 17, Ohio

GM GENERAL MOTORS EUCLID

EUCLID EQUIPMENT

FOR MOVING EARTH, ROCK, COAL AND ORE

. . . for more details circle 311 on enclosed return postal card

Meetings

AMERICAN ROAD BUILDERS ASSOCIATION—Annual Convention, Netherland Hilton Hotel, Cincinnati, Ohio; January 18-21.

NATIONAL LIMESTONE INSTITUTE—15th Annual Meeting, Statler-Hilton Hotel, Washington, D.C.; January 19-21.

AGC OF IOWA—Annual Meeting, Hotel Savery, Des Moines, Iowa; Jan. 20-21.

AGC OF MINNESOTA—Annual Convention, St. Paul Hotel, St. Paul, Minn.; January 21-23.

ASSOCIATED EQUIPMENT DISTRIBUTORS—Annual Meeting, Conrad Hilton Hotel, Chicago, Ill.; January 24-28.

ASSOCIATION OF ASPHALT PAVING TECHNOLOGISTS—Annual Meeting, Hotel Peabody, Memphis, Tenn.; Jan. 25-27.

NEW YORK STATE COUNTY HIGHWAY SUPERINTENDENTS' ASSOCIATION—Winter Meeting, DeWitt Clinton Hotel, Albany, N.Y.; January 27-29.

AGC PACIFIC NORTHWEST BRANCH MEETING, Davenport Hotel, Spokane, Wash.; January 28-29.

TENNESSEE ROAD BUILDERS ASSOCIATION—Annual Convention, Nassau, Bahamas; January 28-31.

NATIONAL BITUMINOUS CONCRETE ASSOCIATION—5th Annual Convention, Sheraton-Cadillac Hotel, Detroit, Mich.; February 1-4.

CONSTRUCTORS ASSOCIATION OF WESTERN PENNSYLVANIA—Annual Meeting, Pittsburgh Hilton Hotel, Pittsburgh, Pa.; February 4.

AGC IDAHO BRANCH—Annual Meeting, Boise, Idaho; February 4-6.

NATIONAL READY MIXED CONCRETE ASSOCIATION—Annual Convention, Conrad Hilton Hotel, Chicago, Ill.; February 15-19.

NATIONAL SAND & GRAVEL ASSOCIATION—Convention and Exposition, Conrad Hilton Hotel and Coliseum, Chicago, Ill.; February 15-19.

NATIONAL CRUSHED STONE ASSOCIATION—Annual Convention and Exposition, Conrad Hiton Hotel, Chicago, Ill.; February 21-25.

AGC KENTUCKY HIGHWAY DIVISION—Annual Meeting, Kentucky Hotel, Louisville, Ky.; February 26-27.

GEORGIA HIGHWAY CONTRACTORS ASSOCIATION—Annual Convention, Oglethorpe Hotel, Savannah, Ga.; February 28-29—March 1.

VIRGINIA AGC—Annual Meeting, Homestead Hotel, Hot Springs, Va.; February 28-March 2.

AMERICAN SOCIETY OF CIVIL ENGINEERS—Spring Meeting, New Orleans, La.; March 7-11.

AMERICAN CONCRETE INSTITUTE—56th Annual Meeting, Commodore Hotel, New York City; March 14-17.

MISSISSIPPI VALLEY CONFERENCE OF STATE HIGHWAY DEPARTMENTS—Edgewater Beach Hotel, Chicago; March 16-17.

ASSOCIATED GENERAL CONTRACTORS OF AMERICA—41st Annual Convention, Masonic Memorial Temple, Fairmont, Mark Hopkins and supporting hotels, San Francisco, Calif.; March 21-24.

THE NEW HANCOCK ELEVATING SCRAPER
(Shown on John Deere 840 Tractor)
FORCED EJECTION • LARGER TIRES • NEW DRIVE
HEAVIER • MORE CAPACITY

Take advantage of these new features that are time and money savers for you! Forced ejection saves you operating time and manpower by providing a positive — controlled dump. Larger tires make the heavier, improved scraper more maneuverable. New, improved drive means heavier loads with less horsepower than ever before . . . 7½ yard and larger capacities. The new Hancock Scraper can be pulled with either the 830 or 730 John Deere, or similar industrial tractor, with front wheel dolly; or by direct connection to tractor. For "Engineered" help with your earth moving problems, contact Hancock today!

HANCOCK MANUFACTURING COMPANY
PO 3-8297 P. O. BOX 1359 LUBBOCK, TEXAS

. . . for more details circle 314 on enclosed return postal card

Geared by Fuller with off-highway '1220 Series Transmission . . .

Faster work cycles with countershaft brake and longer life with pressure filtration system

Eight Allis-Chalmers TS-260 Scrapers with Fuller off-highway '1220 Series Transmissions are boosting profits for Ben Haskins Construction Company on Oklahoma highway projects. All 8 of Haskins' '1220 Series Transmissions are equipped with Air-Powered Countershaft Inertia Brakes and Pressure Filtration Systems for the gear oil.

President Ben Haskins says, "Fuller '1220 Transmissions have helped make our operation more profitable. They're trouble-free. The transmission countershaft inertia brake permits quick, easy upshifts without double clutching. Faster shifting gives us faster work cycles . . . the pressure filtration system for the gear oil prolongs gear and bearing life . . . I'll insist on both the brake and the pressure filtration system when I buy equipment in the future."

For long life, easy shifting and positive lubrication in your scraper operations, specify Fuller off-highway Transmissions which include the countershaft inertia brake and pressure lubrication and filtration systems as standard equipment. Ask your dealer about these new features designed to provide *you* with a better margin of profit.

FULLER — TRANSMISSION DIVISION — MANUFACTURING COMPANY

KALAMAZOO, MICHIGAN

Subsidiary EATON Manufacturing Company

Unit Drop Forge Div., Milwaukee 1, Wis. • Shuler Axle Co., Louisville, Ky. (Subsidiary) • Sales & Service, All Products, West. Dist. Branch, Oakland 6, Cal. and Southwest Dist. Office, Tulsa 3, Okla. Automotive Products Company, Ltd., Brock House, Langham Street, London W.1, England, European Representative

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YESTERDAY it was the St. Lawrence Seaway and a record span across the Straits of Mackinac. Today it's a missile launching pad. Tomorrow, who knows? But whatever new projects lie ahead, contractors have a right to expect their bonding service and their insurance protection to be just as modern as their bold new ventures.

THE FIDELITY AND CASUALTY COMPANY OF NEW YORK keeps pace with progress. New projects are carefully studied, the risks analyzed and solutions found. When safety engineering service is needed, F & C provides it.

This is your assurance of bonding service that fits your specific needs—skillfully-patterned insurance that gives you the best in protection.

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People

W. G. Gunn Goes to Penn. Constructors

W. Guy Gunn has been appointed public relations director and assistant to executive secretary A. E. O'Brien of the Associated Pennsylvania Constructors, Harrisburg. He has recently held the post of managing director, American Road Builders Association's contractors division, Washington, D.C., where he made a nationwide name in building up ARBA contractor membership.

W. G. Gunn

Dietrich Heads Steel Constructors

H. Buckley Dietrich, president of Dietrich Brothers, Inc., Baltimore, Md., is re-elected president of the American Institute of Steel Construction, national association of the structural steel fabricating industry.

Other AISC officers for 1960: 1st vice-president, James M. Straub, president, Fort Pitt Bridge Works, Pittsburgh, Pa.; 2nd vice-president, Harold G. Lewis, president, Flint Steel Corporation, Tulsa, Okla.; secretary, M. Harvey Smedley, New York City; treasurer, Erwin P. Stupp, president, Stupp Brothers Bridge & Iron Company, St. Louis, Mo.

L. Abbett Post, New York City, who has been executive vice president since 1947, was re-elected to the top administrative position.

JAMES C. BUNYARD, of Columbus, Miss., has been appointed district engineer for the Asphalt Institute at Atlanta, Georgia. He has been

Continued on page 36

MONARK TRACK ATTACHMENTS

SAVE YOUR MONEY — Buy Your Crawler Spares in Germany

MONARK specialists guarantee first quality replacement track parts of latest heavy execution for

CATERPILLAR • INTERNATIONAL • ALLIS CHALMERS, etc.

Genuine MONARK spares — parts you can trust!

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We deliver tracks with and without grouser shoes, idlers, sprockets, bottom rollers and top rollers for all types of tractors as CATERPILLAR, ALLIS CHALMERS, INTERNATIONAL etc.

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People

Continued from page 34

chief engineer at the Columbus (Miss.) Air Force Base of the Strategic Air Command. In his new position he will serve Georgia, Florida and South Carolina under the Institute's Atlantic-Gulf Division managing engineer Wright Hiatt at New York.

C. S. WHITNEY, widely known construction consultant and textbook author, died recently at age 66. He was a partner in the consulting firm of Ammann and Whitney, and an authority on reinforced concrete structural design.

L. M. CLAUSON, recently deputy chief engineer, has made chief engineer of the Iowa state highway commission. He succeeds John G. Butter. R. M. Tutton, district engineer at Cedar Rapids, is moving to the deputy chief engineer position.

SYLVESTER E. RIDGE, recently Assistant Chief, Division of Development, Office of Operations, Bureau of Public Roads, U. S. Department of Commerce, has been promoted to the position of Special Programs Coordinator, Office of Assistant to Federal Highway Administrator. Mr. Ridge will be responsible for directing Public Roads activities in the coordination of water resources projects and highway development, including the treatment of navigational clearance in highway bridges, and for other duties.

CARLOS A. WEBER, chief engineer, Michigan state highway department announces that he will retire at the end of 1959. Mr. Weber is one of the oldest employees in his department, having started as a rodman in 1920 and worked through various departments increasingly upward.

BURT L. KNOWLES, widely known in the construction industry, has retired after 25 years of service with the Associated General Contractors Washington headquarters staff. He will continue as a consultant for the AGC.

HOLDEN A. EVANS, Jr., general manager, New York State Thruway Authority, has been elected president of the American Bridge, Tunnel and Turnpike Association, Inc., which has headquarters at White Plains, New York.

CHARLES E. MCKEE, executive secretary of AGC's Ohio Highway Chapter, died recently. A former director of the Ohio department of highways, McKee while with AGC achieved conspicuous leadership in uniting the state's contractors and engineers on improved highway specifications and job procedures.

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Don't Scrap Giant Tires When Retreads Do the job at half the Cost
Giant size savings plus new tire mileage are yours when you specify Southern Tire's expert retreading service.
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WALKING 95,000 lbs. OF STEEL

INTO PLACE!

It's the big problems that really test a crane and a 95,000 lb. steel beam is a big problem.

The job was a Chesapeake and Ohio R.R. overpass at Muskegon Heights, Mich. The contractor was L.W. Lamb Co., of Holland, Michigan, who has been building an outstanding name for himself in western Michigan by solving big problems.

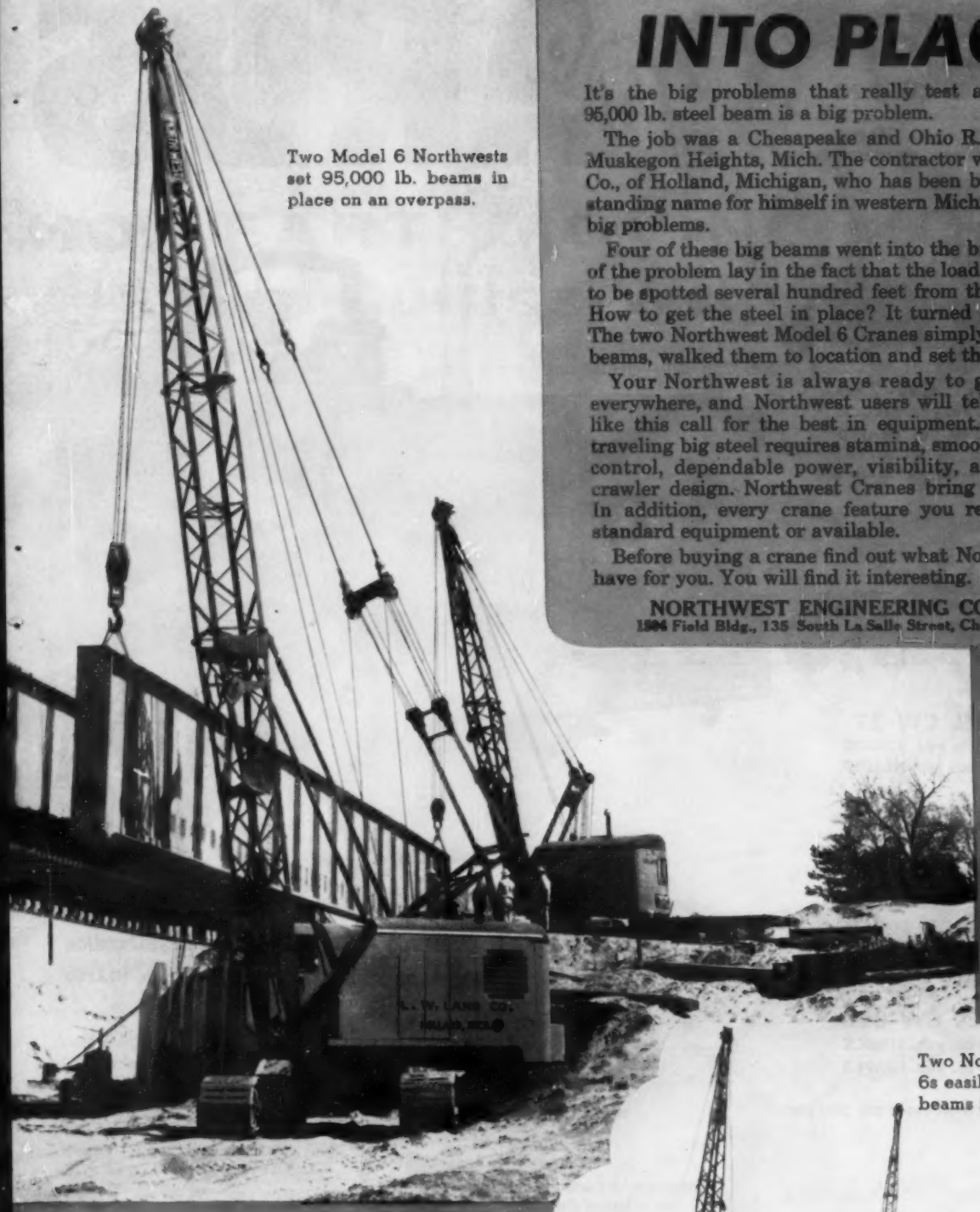
Four of these big beams went into the bridge. The crux of the problem lay in the fact that the loaded flat cars had to be spotted several hundred feet from the bridge piers. How to get the steel in place? It turned out to be easy! The two Northwest Model 6 Cranes simply picked up the beams, walked them to location and set them in place.

Your Northwest is always ready to go! We hear it everywhere, and Northwest users will tell you so. Jobs like this call for the best in equipment. Handling and traveling big steel requires stamina, smooth and accurate control, dependable power, visibility, and sure-footed crawler design. Northwest Cranes bring you all of this. In addition, every crane feature you require is either standard equipment or available.

Before buying a crane find out what Northwest Cranes have for you. You will find it interesting.

NORTHWEST ENGINEERING COMPANY
1504 Field Bldg., 135 South La Salle Street, Chicago 3, Illinois

Two Model 6 Northwests set 95,000 lb. beams in place on an overpass.



Two Northwest Model 6s easily walk the big beams into place.

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MODEL CW-27
7.0 cu. yds. STRUCK
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MODEL CW-226
26.0 cu. yds. STRUCK
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MODEL CW-320
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INTERCHANGEABLE WITH MODELS:-CW-220

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31.0 cu. yds. HEAPED
35-TON LOAD CAPACITY

MODEL CWT-20
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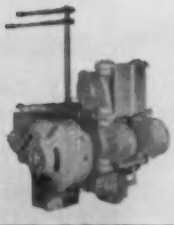
27.0 cu. yds. HEAPED



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New Publications

Booklet on Steel Bridge Competition

New ways to use the higher strength-to-weight ratios of modern structural steels in bridge design are suggested in a 38-page booklet. Covering the 15 winning designs in a recent $44,000 Steel Highway Bridge Design Competition, the booklet illustrates structural details of the prize-winning entries, discusses their noteworthy features, and gives background information on the designers.

Sponsored by American Bridge Division, U. S. Steel Corp., the Competition was held to "stimulate more imaginative and effective use of steel in highway overpasses." Conducted and judged under the auspices of the American Institute of Steel Construction, it drew more than 300 entries from the U. S. and 29 foreign countries.

A free copy of the booklet is available upon request to American Bridge Division, U. S. Steel Corp., Room 1831, 525 William Penn Place, Pittsburgh 30, Pa.

1959 ACI Book of Standards

The 382-page, 1959 edition of the ACI Book of Standards is the most recent compilation of current ACI standards, recommended practices, and specifications. Fifteen Standards are compiled under one cover, incorporating such subjects as winter concreting; hot weather concreting; selection of proper mix proportions; and the measuring, mixing and placing of concrete.

Other standards cover test procedure to determine relative bond value of reinforcing bars; evaluation of compression test results of field concrete; and other subjects.

Among the fifteen Standards is ACI 325-58, which present recommendations for the design of rigid concrete pavements and bases based on practice proved successful in the United States. It offers detailed design help on rigid airport and highway pavements or bases for conditions of climate, traffic, available construction materials and equipment, and construction methods.

ACI 617-58 is included, giving specifications which apply to construction of portland cement concrete pavements and bases under normal conditions for both highways and airports.

The book is available at $5.00 from the American Concrete Institute, P.O. Box 4754, Redford Station, Detroit 19, Michigan.

New Reference on Prestressed Concrete

Practical Prestressed Concrete. By H. Kent Preston, John A. Roebling's Sons Division, the Colorado Fuel and Iron Corporation. 335 pages, 6 x 9, 136 illustrations.

Continued on page 44

INGRAM

3 WHEEL and TANDEM ROLLERS

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Two ways to lower compaction costs with fast, high-density Lima Roadpackers

- ***Compact to 100% density in one pass***—often possible with Lima Roadpackers.
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High-production Roadpackers speed construction of highways, parking lots, airfields and earth-fill dams. Vibratory compaction works from bottom to top; fills voids, eliminates shoving. Roadpackers work forward or in reverse. Compact in varying widths and speeds. Travel on-the-job or over-the-road at highway speeds.

Lima Roadpackers are extremely popular with cost-conscious contractors everywhere who are interested in both high performance and low maintenance. Vibrator units are completely sealed, self-lubricated. No external moving parts; no daily maintenance required.

Two Model Roadpackers now available

MODEL D—Six hydraulically controlled vibrator shoes compact up to 600 tons per hour in a 13 ft.,1 in. swath. End shoes fold up for narrow width compaction path or highway travel at speeds up to 30 mph. Compacts from 20 to 95 feet per minute using 4, 5 or 6 shoes.

SUPER—More than doubles compaction performance of any multiple-shoe vibrator machine. Designed for really big jobs. Two rows of six vibrator shoes, hydraulically controlled, compact "tough-spec" materials on production basis from 26 to 268 feet per minute in widths to 15 ft. Highway travel to 24 mph; power brakes and steering, tandem rear drive.

Get compaction cost-cutting facts from your nearby Lima distributor or write to Baldwin-Lima-Hamilton Corporation, Construction Equipment Division, Lima, Ohio.

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605

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Behind Mr. Black his new 2¼ cu. yd. TD-15 Four-in-One is roughing out a new street with the earthrolling bulldozer action. He can compete with a dozer outfit—because the clam-action 4-in-1 can duplicate bulldozer performance, in capacity, range, and accuracy of control.

Power-shovel-like excavating force—applied with 4-in-1's super-powerful pry-over-shoe break-out action—enables the operator to heap 'er full, every pass, even in hard digging. The "15" can deliver 39,200 lbs. of break-out force!

"Other rigs only 'doze, or grade, or load

...my TD-15 Four-in-One does ALL...and more"

—T. P. BLACK, SR., CHEYENNE, WYOMING

To grade in cramped quarters—to load elusive loose materials without "chasing" them—the 4-in-1's operator simply uses a back-drag motion of the clamshell! Use this same action to do positive, self-clean-out bottom dumping—that eliminates the sticky materials problem.

Using carry-type scraper action, Mr. Black's 4-in-1 operator grades with inch-close accuracy. Note how the earth "boils in" to heap-load the 4-in-1 speedily. This action can also be used to strip sod or topsoil—and do controlled spreading, on-the-go!

"I tried other machines," reports T. P. Black, Sr., Cheyenne, Wyoming, "but they couldn't compare with the International Drott 4-in-1." Other rigs, he found, could either load, or do dozer work, or grade, only.

"The 4-in-1 can do all and much more," he adds. "We excavate, bulldoze, load trucks, do rough or final grading on roads, or landscaping. Our TD-15 and TD-9 Four-in-Ones are perfect for everything. I can't do without them in my business."

All four International Drott diesel-powered 4-in-1's give you the smoothness and wallop of high-torque 6-cylinder engines. The "15" Four-in-One is powered by the millions-of-hours-proved 115 hp, 6-cylinder International D-554 diesel. And the "15" gives you the cycle-speeding advantages of 6-speed full-reverse transmission—with "single-stick" shift and Shuttle-Bar forward-reverse control. Plus high efficiency, dry-type sintered metal clutch facings!

Why limit your income to what an old-style single-action loader, or any other limited-duty rig can earn you? See how each of the four, big-capacity 4-in-1 actions "doubles" for one or more special-duty machines—and each action gives you an amazing range of job-handling working positions. Compare exclusive shock-swallowing Hydro-Spring advantages, for positive, performance protection. Prove to yourself that only the clam-action 4-in-1 can upgrade you to multi-operation profits! Let your International Drott Distributor demonstrate.

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Cleveland 80W lays pipe for 13-mile sewer line—does backfilling, too

G. C. McLeod Co. of Edmonton, Alberta made extensive use of its Cleveland 80W for laying 20" and 8" asbestos pipe on a 69,000-foot sanitary sewer line in Nanaimo, B. C. Even in the extremely wet and heavy mud of the salt water tidelands shown above, construction moved ahead 800–1,300 feet daily. As the line progressed into drier ground, the 80W was further employed in backfilling and cleanup operations.

THE ONE-MAN-OPERATED 80W

- **DOES SIDEBOOM WORK OF ALL KINDS,** unloads, strings, lays pipe, sets valves, hydrants, etc.
- **BACKFILLS SPOIL** clean and fast from *either* side of trench.
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Check with your distributor now—get the complete 80W story

The CLEVELAND TRENCHER Co.

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Publications

Continued from page 40

$11.50. McGraw-Hill's Industrial and Business Book Information Service, 327 W. 41st Street, New York 36, New York.

This new book furnishes the busy structural engineer with simplified information on the design of safe, economical structures of prestressed concrete. Basic principles, design procedures, and numerical examples are presented in terms of simple arithmetic and standard stress and moment formulas familiar to all structural engineers. All design examples are based on Tentative Recommendations for Prestressed Concrete prepared by an ACI-ASCE committee of experts.

The approach is practical, and several numerical design examples are carried through from beginning to end. In several of the examples, inadequate members or tendons are chosen—common in actual design practice—and then the example proceeds to show how to correct the situation. At many points, too, the mathematical treatment is interrupted so that the economy of the section can be considered before the design proceeds too far. As an aid to the design of structures, construction methods and equipment are discussed, with special emphasis to prestressing tendons which are used in this country.

Among the topics discussed are properties of prestressed concrete, design procedures, materials pretensioned and post-tensioned methods and when each should be used, and the design of typical members, girders, piles, and continuous structures. Handy tables and appendixes give information on properties of strands, wires, and bars, and specifications and recommendations for prestressed concrete design.

A Total Strategy For Urban Areas. By Wilfred Owen, The Brookings Institution, Washington, D. C., 722 Jackson Place, N. W. Single copy free, quantities 25¢ each. A pamphlet reprinted with permission from the author's book "Cities In The Motor Age".

Continued on page 50

Out of the proven skill and experience of The Eimco Corporation comes the . . .

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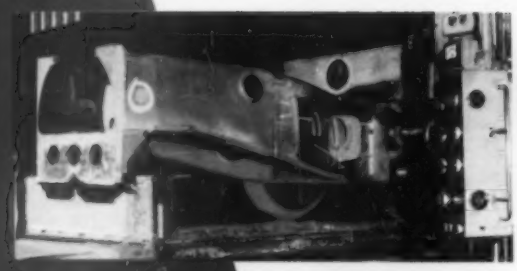
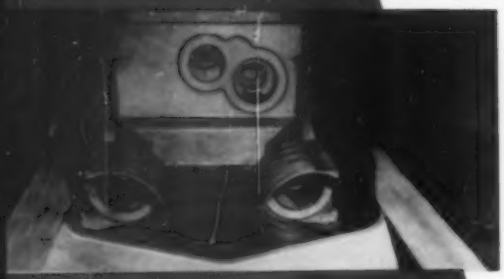
The modern 100 HP
EIMCO 103 CRAWLER-TRACTOR LINE...

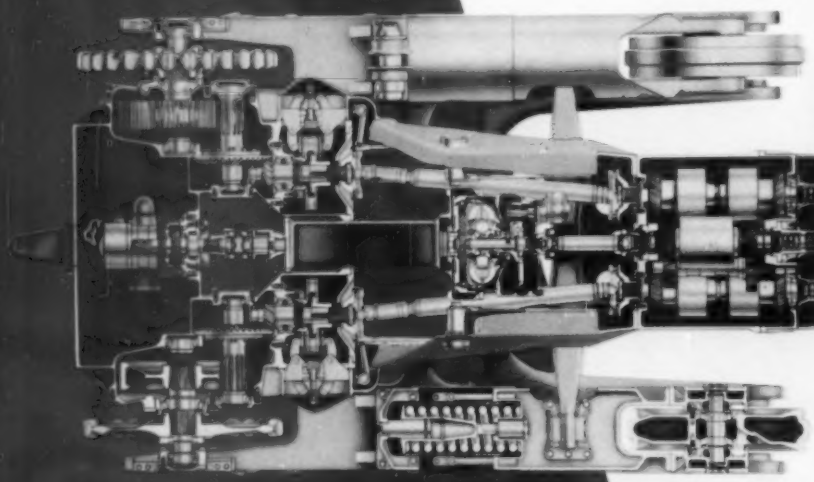
Features? Look ...



Main frame, Final Drives and Center Housing, produced, through Eimco's unique and exclusive Unitized "Stress Flow" Construction, in a single, strong steel casting, resists torque and stresses beyond any you can place upon it.



Thoroughly tested and proven, engineers checked and analyzed a precise and complete wooden mock-up before the first steel casting was made ... built in extra strength and rigidity where needed. No welds or bolts in this assembly! Just like the heaviest locomotives, it is built for many extra years of trouble-free operation, with no excess weight ... extra strength where it is needed.



Take a good look at this horizontal cut-away view of the modern 103 crawler-tractor. Here is perfection in engineering ... brilliantly simple ... ruggedly strong ... incorporating more exclusive and important "firsts" than any other crawler-tractor on the market today. Built by craftsmen who care ... the famous craftsmen and specialists of The Eimco Corporation, known throughout the free world for highest quality and dependability.

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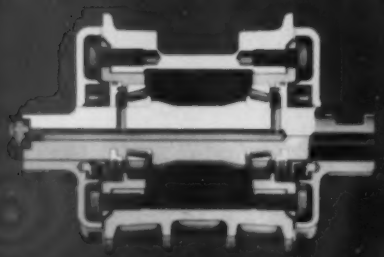
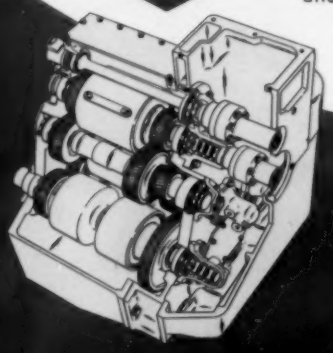


Track rollers are one-piece heat treated alloy steel castings with extra oversize tapered roller bearings, each fitted in its own cage, with precision-lapped seals.



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SALT LAKE CITY, UTAH — U.S.A.

"CLASH-BOX" robbing your CASH-BOX?

Crawlers without full-power shift are obsolete . . . and costly!

If your crawlers have master clutches and manual shift transmissions—"clash-boxes" as they're commonly called—you may be passing up profits that should be yours.

With proven Torqmatic Drive in the Model C-6 and the TC-12, Euclid Crawlers provide full-power shift and instant reverse. There's no loss of power or momentum when changing from one speed range to another . . . no delay for clutching and shifting . . . and with a flick of the wrist you change travel direction fast. It's a dependable power train, too . . . proved in thousands of "Euc" earthmovers on every kind of job.

Have your dealer show you how Euclid Crawlers have more productive capacity on any tractor work . . . dozing, ripping, push loading big scrapers, or towing heavy loads. The seconds they save on every work cycle can add up to more cash in your your cash box!

EUCLID Division of General Motors, Cleveland 17, Ohio
Plants at Cleveland and Hudson, Ohio and Lanarkshire, Scotland.

Proven Torqmatic Drive provides smooth steady flow of power . . . full-power shift . . . instant reverse . . . easy operation. For push loading scrapers the fast maneuverability of "Euc" crawlers cuts scraper cycle time and steps up production . . . changes from one speed range to another, and from forward to reverse and back again, are made under full power . . . there's no clutching.

. . . for more details circle 312 on enclosed return postal card

EUCLID EQUIPMENT

FOR MOVING EARTH, ROCK, COAL AND ORE

Operator demonstrates hydraulically controlled side-shifting action of blade on 6-wheel Austin-Western power grader.

All-purpose Austin-Western graders speed highway project...shorten job by 2 months

"We completed a 3-mile dual highway project 2 months ahead of schedule with the help of our three Austin-Western graders," says Charles Solomon of S. D. Solomon & Sons, Pontiac, Mich.

Versatile A-W's unsurpassed

He tells us, "The A-W's are versatile machines. They can do many more kinds of work than any other single grader sold. They're unsurpassed for jobs in sand or tight corners. They do rough or finish grading, sloping and ditching equally well. We have three Austin-Westerns—a 4-wheeler and two tandems. Maintenance on these machines has been very low.

"As far as I'm concerned, Austin-Westerns are the best graders sold. They far outperform any other grader made."

Austin-Westerns feature exclusive all-wheel drive and steer on both 4 and 6-wheel models. You move more dirt farther and faster with an A-W because of power up front. No dead weight front end to push around.

All-wheel steering permits you to steer the rear to compensate for powerful side-thrust of a fully loaded blade. You can use the full 13-ft. moldboard and still grade ahead in a straight line. Front and rear steer provide amazing maneuverability for short radius work. An A-W can work in close quarters where other graders cannot.

Built to outperform

Austin-Westerns are quality built to outperform! Maintenance requirements are low. Distributor service is excellent. Choice of gas or diesel power. Torque converter optional. Hydraulic controls reduce operator fatigue . . . increase his efficiency.

Learn how Austin-Western graders can speed your jobs to give you added profit! See your nearby A-W distributor or write us today.

Rear steering permits operator to offset machine for extra blade reach in this finish grading operation.

Austin 100th YEAR Western

CONSTRUCTION EQUIPMENT DIVISION, AURORA, ILL.

BALDWIN · LIMA · HAMILTON

Power graders • Motor sweepers • Road rollers • Hydraulic cranes

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Publications

Continued from page 44

NATURE AND PROPERTIES OF ENGINEERING MATERIALS. By Zbigniew D. Jastrzebski, professor of chemical engineering, Lafayette University. 571 pages. Price $11.00. John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. Deals with basic concepts including molecular forces, relating chemistry, physics and engineering practice.

CONCRETE PAVEMENT: SUBBASE AND JOINT CONSTRUCTION, Bulletin 229. Highway Research Board, 2101 Constitution, Washington, D. C. Price: $1.00. A 53-page bulletin containing three papers presented at the 38th annual meeting of the Board:

(1) "Performance of Concrete Construction Methods," by Phil Fordyce and J. D. Gessaman, points out that uniformity of gradation has the most influence on pavement performance, with material of small maximum size generally performing better than coarser materials. Also, heavy construction traffic on the completed subbase nullifies the efforts expended to obtain uniformity.

(2) "Joint Construction in Concrete Pavement," by Gordon K. Ray, discusses the correct construction procedures for various types of joints, pointing out how incorrect practices result in substandard performance of the finished pavements.

(3) By Egons Tons, "A Theoretical Approach to Design of a Road Joint Seal."

PHYSICAL PROPERTIES OF STRUCTURAL QUALITY LIGHTWEIGHT-AGGREGATE CONCRETE. Research report by Jones, Hirsch and Stephenson, Texas Transportation Institute, Texas A. & M. College System, College Station, Texas. Based on work of research committee in the Texas highway department.

PHOTOGRAMMETRY: DEVELOPMENTS AND APPLICATIONS, 1959. Bulletin 228, Highway Research Board, 2101 Constitution, Washington, D. C. 68-page bulletin. Price: $1.20.

To every contractor who has to make a profit this winter

Rugged trench hoe digs through blasted rock and frozen earth at height of Montreal's harsh Winter.

AT MINUS 25 degrees, Manitowoc 1¼-yd. hoe trenches 200 feet each 10-hour shift in frozen, blasted rock

Despite severe temperatures hovering between 20° to 25° below zero last winter, this 1¼-yd. Manitowoc Trench Hoe averaged 200′ of dynamite-blasted rock and frozen earth each shift for Civil Construction, Inc. of Montreal, Quebec.

ROCK ALL THE WAY

The job involved two major sewer projects for the Corporation de Montreal Metropolitan (Metropolitan Commission for Public Works) covering over 22,000 feet of sewer trench budgeted at a total cost of $355,000. Each trench was excavated 10 to 12 feet deep, and 8 feet wide. Every foot of the job was in quarry rock that had to be blasted before the Manitowoc could move in to work.

NO REPAIRS

Taking the severe weather and tough digging in stride, the hoe put out top yardage that would have been good even under ideal working conditions — and with minimum service and attention. On this point Mr. Paul F. Tremblay, Vice President of Civil Construction, Inc., said, "We have spent almost nothing on repairs or maintenance for our Manitowoc hoe since acquiring it last Winter. At the same time, we spent over $28,000 in repairs and maintenance on our rigs of other makes. Yes, we are confident that this trench hoe will more than do its part in giving us profitable operation with a minimum of maintenance and repair costs."

Stabilize *your* profit picture this Winter with an excavator-crane that can keep the output "hot" even at minus zero temperatures. Get more information NOW about the big-yardage Manitowoc that best suits your business.

Manitowoc

SHOVELS 1¼-6 YDS. • CRANES 25-125 TONS

MANITOWOC ENGINEERING CORP. PASTE ON POSTAL CARD
(A subsidiary of The Manitowoc Company, Inc.)
MANITOWOC, WISCONSIN Dept. R5

Send complete information on:
☐ 1¼-yd. ☐ 1½-yd. ☐ 2-yd.
☐ 2½-yd. ☐ 3-yd. Trench Hoe
☐ Other excavators to 6-yds.
☐ Cranes from 25 tons to 125 tons

NAME.....
TITLE.....
COMPANY.....
STREET.....
CITY..... STATE.....

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The BUTLER TX-4 Roadbuilder's Plant

Adapts to

1 2 3 or 4 Pavers...

So What's the Problem in Making Your Choice of Batching Equipment?

Start with a One Paver Set-up . . . Expand Your TX-4 as You Grow

The basic TX-4 provides two TX-4 bins, one compartmented for cement and sand, the other for two sizes of stone. This easily handles one or two dual drum pavers.

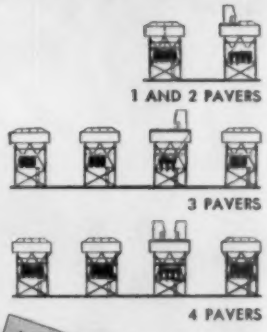
Then for three pavers, simply add two more bins with batchers.

And for four dual drum pavers, just add a batcher to each of the four bins. It's as simple as that. The diagrams at the right tell the story.

The TX-4 . . . Simplest and Fastest to Erect, Dismantle and Move

Bin section is complete, ships and erects in one piece. Batcher section also is complete, erects as a unit. All piping and wiring are in-place. Quick connectors for air and current make hook-up a matter of minutes.

So buy a plant of adequate expandability — and avoid going through the bother of trade-ins, delivery delays and awkward, costly time-consuming moves from job site to job site. Settle your problems now, once — and for all — with a BUTLER TX-4.



Do you want to know more about the Butler TX-4 and its versatility in production? Just write "TX-4" on a postcard with your name and address. We'll rush complete details immediately.

BUTLER BIN COMPANY

959 Blackstone Avenue • Waukesha, Wisconsin

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Some of Utah's civic leaders making tour of state highway construction projects in the Salt Lake City metropolitan area.

Civic Leaders Get "Eye Opening" Tour

"Surprise and pleasure at the amount of highway work completed or under way in the area." That was the response to a recent 59-mile tour of state projects in the Salt Lake City area conducted by the State Road Commission for 60 civic leaders.

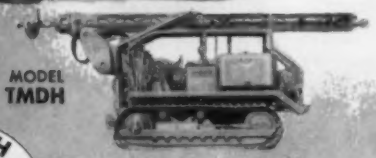
Attending the tour were members of the state's Highway Committee, Salt Lake City Chamber of Commerce and the Salt Lake County Highway Association. The group traversed the route in two large buses, with commentary furnished by the district engineer staff. Also along were selected top administrative personnel of the road commission and the BPR division office.

A brochure containing maps and locations of recent projects and projects planned for 1960 were distributed to the group; also given out was a colorful booklet commemorating the Golden Anniversary of the road commission.

This type of "see for yourself" tour is recommended by the Utah commission as a means of acquainting influential citizens with the problems as well as progress in the road program. The trip paid immediate dividends by generating considerable newspaper publicity.

A WILLIAMS DIGGER FOR EVERY PURPOSE!

Available in twelve models and a wide range of hole diameters from 12 to 96 inches and depths to 110 feet. Whether truck, tractor or specially-mounted the Williams Diggers will serve any purpose and, in this respect, are virtually custom rigs for the earth-boring contractor. Williams Diggers are unexcelled for sinking holes for everything from electric line poles to architectural foundation piers.



HUGH B. WILLIAMS MFG. CO.
8330 Lovett Ave. • Dallas, Texas
Manufacturer

JOSLYN MFG. & SUPPLY CO.
2101 Corinth St. • Dallas, Texas
Distributor

WRITE FOR ILLUSTRATED DESCRIPTIVE LITERATURE

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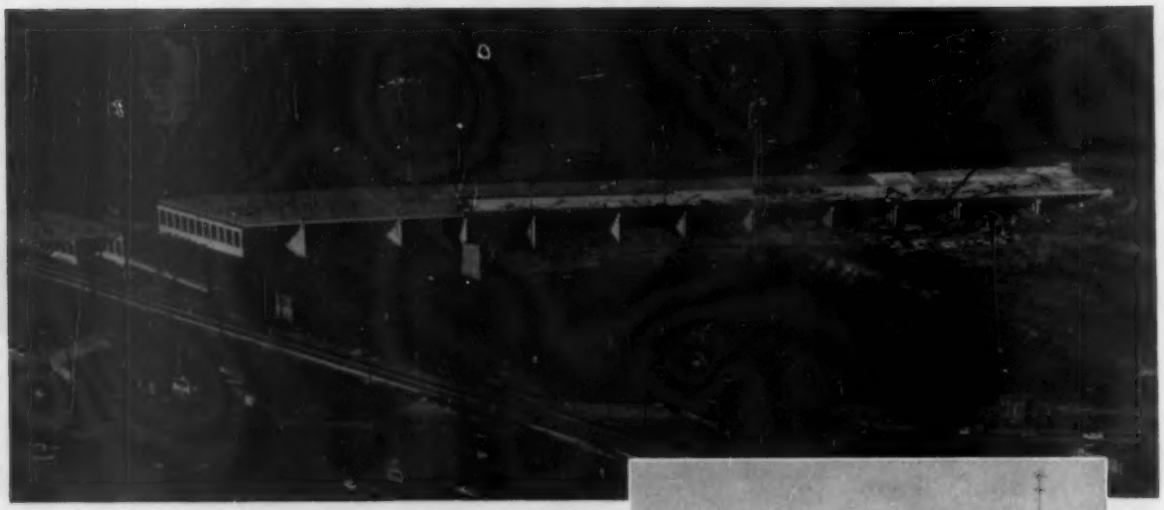

LACLEDE REINFORCING STEELS strengthen new Illinois interstate system

This section of the new East St. Louis Expressway will soon become a part of the Interstate and Defense Highway U. S. Route 70 and 44. Approximately 1100 tons of Laclede reinforcing bars were furnished for this project, which spans the major mainline railroad tracks connecting St. Louis and the East.

Put the complete line of Laclede reinforcing steels and services to work on *your* next job.

CONTRACTORS
H. H. Hall Construction Company, East Saint Louis, Illinois
Fruin-Colnon Contracting Company, Saint Louis, Missouri

LACLEDE

LACLEDE STEEL COMPANY

SAINT LOUIS, MISSOURI ◆ Producers of Steel for Industry and Construction

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Wyoming "Need" Study

A state-wide study of long-range highway needs is in progress by the Wyoming highway department aided by the Automotive Safety Foundation of Washington, D. C. A related finance study has been started by the University of Wyoming.

The ASF is reportedly planning to recommend regrouping of various state and county road systems into more efficient units, and remodernizing of the road administration as well as a program for correcting physical deficiencies in the highways.

Toll Expressways?

Tolls for expressways in the Chicago area were advocated recently by Charles L. Dearing, executive director of the Illinois State Tollway. He said that toll barriers should be considered as means of partially financing selected projects, rather than for completely self-liquidating schemes, as a means of hastening construction where the slowed-down federal highway program has forced postponement of projects.

Steel Grids De-Slicked

Blobs of plastic and grit have cut skidding accidents on the steel grid of a bridge in Alameda County, California. The mixture utilizes Epon Resin, a plastic adhesive developed by Shell, and emery. The mixture is applied to the cross points of the grid, which can become as slick as ice in wet weather. The Epon bonds to the steel.

EXPLOSIVES NEEDED IN CONSTRUCTION of the Interstate highway system have been estimated at from zero up to 153,000 lb. per million dollars of contract construction cost, as shown in a recent compilation by the Bureau of Public Roads.

MORE THAN ONE-FOURTH OF THE EQUIPMENT owned by the average U. S. contractor is at least five years old, according to a recent survey, and some 30 percent of his crawler tractors have reached the five-year stage.

ESSICK
VIBRATING COMPACTORS

Essick VR-28-W Self-Propelled Vibrating Compactor on Golden State Freeway

COSTS CUT IN HALF . . .
PRODUCTION TRIPLED . . .
SPECIFIED DENSITIES EXCEEDED . . .

ESSICK 28" VIBRATING COMPACTOR OUTPERFORMS OTHER EQUIPMENT ON SOIL OR ASPHALT

Charlie Brown of the Chas. T. Brown Construction Company states:
"We were working on the Golden State Freeway in Los Angeles, compacting backfill around bridge abutments and drainage pipes. At the start of the job, compaction costs were running about $1,300 per month per compaction unit which consisted of a compressor and three pneumatic tampers.

"Having successfully used Essick Vibrating Compactors on other projects, we felt that we could get better densities at less cost in the confined areas of this job with the Essick 28" self-propelled vibrating model.

"We put the Essick VR-28-W to work and cut monthly costs to about $650 per compaction unit (about one-half), tripled our production, and exceeded our best past compaction performance. Being self-propelled, the Essick 28" Vibrating Compactor is just the ticket for backfill operations on soil and in hard-to-get-at locations. It gives the most compaction at the least expense, and exceeds specifications in record time."

Many Contractors are finding that the 865 lb. VR-28-W, with its High Frequency Vibration, exceeds the compaction of a sixteen-ton static roller on soil. This multiple purpose tool has also revolutionized highway maintenance by putting down better asphalt patches at greatly reduced costs. Carrying hooks make it completely mobile, and being self-propelled, it will go just about anywhere compaction is required.

SEE YOUR ESSICK DEALER FOR A DEMONSTRATION

9 Models of Vibrating Compactors from 13" to 72" widths

Also 14 Models of Tandem Rollers from ½ to 14 Tons

ESSICK MANUFACTURING COMPANY

1950 SANTA FE AVENUE
LOS ANGELES 21, CALIFORNIA

850 WOODRUFF LANE
ELIZABETH, NEW JERSEY

Affiliated with THE T. L. SMITH CO., Milwaukee, Wisconsin

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Snow Removal a Problem?

Think of **FRINK**

Specialists Since 1921 in

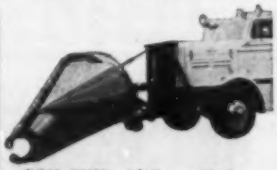
SNOW PLOW KNOW-HOW

Since the first steel plow (a Frink) hit the highway, every major advance in snow plow design and performance has been a product of Frink "know-how." Today there are four basic types of Frink Sno-Plows, each with models to fit trucks from 1½ to 12 tons, and most are interchangeable on the same attachment.

Whatever your area's snow removal problem, Frink makes THE plow best equipped to do the job faster, safer and at lower operational cost for plow **and truck.**

Learn all the facts and reasons why so many cities, towns, counties and states specify Frink Sno-Plows. See your distributor or write to Frink for descriptive folders about these plows.

V-TYPE SNO-PLOW
—rugged powerhouse for high-speed, heavy-duty highway work; leveling wings optional.



ROLL-OVER with Taper Blade
—for airports, expressways; rotates left or right in seconds; ends "dead-heading."

ONE-WAY with Trip Blade
—for high-speed throwing and spreading, but windrows neatly at city speed.

REVERSIBLE Trip Blade
—all-purpose; plows left, right, bulldozes ahead; power reverse lever in cab.

For Snow Plow Know-How It Pays to Think of FRINK SNO-PLOWS

FRINK SNO-PLOWS, INC., CLAYTON, N. Y.
Eastern Steel Products, Ltd., Preston, Ontario-Canada

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Traffic Safety

Texas Has Big Safety Sign Program

The largest single order for reflective coating high intensity glass spheres ever placed has been delivered to the Texas highway department for use in reflectorizing road signs.

The order for 35,000 lb. of Cataflex "202" extra high intensity glass spheres was awarded to Cataphote Corporation on a competitive bid (of 99¢ per lb.). Shipped to the highway department supply center at Seguin, Texas, the beads will be used in reflective coating new and replacement signs for maximum night and bad weather visibility under the state's continuing sign modernization program.

Cataphote had also won the bid on the largest single order for highway marking beads from the state of Texas in 1955.

Signals and Night Accidents

Readers interested in this subject may desire to obtain "Public Roads," October, 1959, published by the Bureau of Public Roads and available from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 20¢ a copy.

Reported by David A. Soloman, highway research engineer, Traffic Operations Division of the Bureau of Public Roads, this review analyzes intersection accidents, relating them to the circumstances involved including the signalization.

The author while noting that more precise and complete information is needed to determine the conditions under which stop-and-go signals or flashing beacons may be most effective, does indicate more widespread use of flashing beacons would be desirable at the simpler types of intersections.

The author further recommends that a general and large-scale study should be undertaken of the relation between various design features of intersections and the accident pattern, to determine what type of traffic control device should be employed at the location.

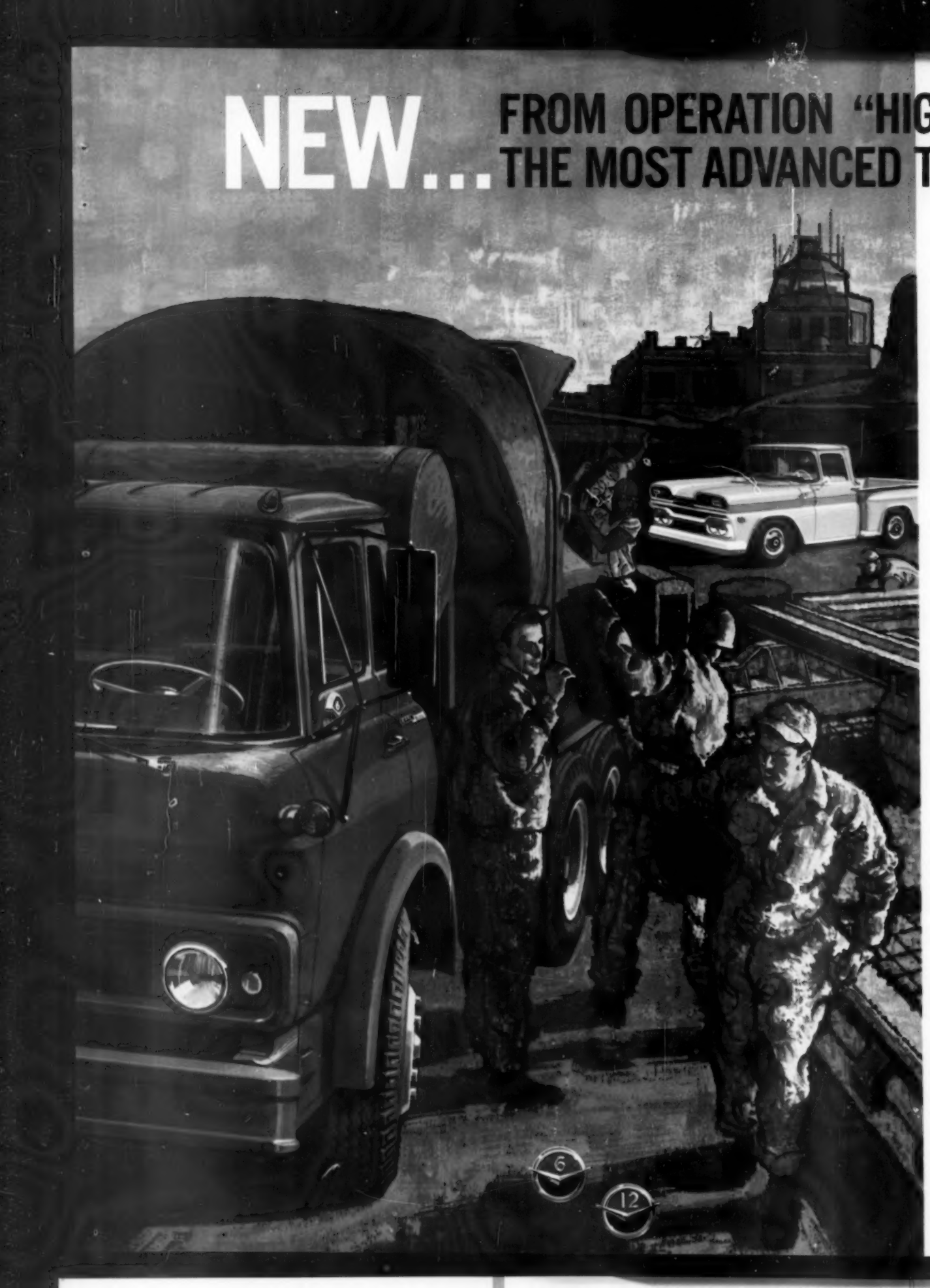
One possible method for reducing accidents would seem to be the use of flashing signal operation of certain stop-and-go signals during inclement weather.

Oversize Traffic Signals Reduce Accidents

Highway commissioner John C. Mackie cited oversize traffic signals for a sharp reduction in accidents and injuries at five urban intersections on Michigan's trunkline system.

One-year before-and-after studies indicate that accidents at these five intersections (located in four counties) dropped from 125 to 74, a 40.8 percent reduction; injuries dropped from 42 to 18, or 57.2 percent. Fatalities rose from 1 to 3 at one intersection, but all three persons were killed in one accident and traffic engineers believe the severity still shows a decrease since total persons injured at this intersection dropped from 8 to 4.

The normal 8-in. signal heads were replaced with 12 in. heads at these intersections.


NEW....
FROM OPERATION "HIG
THE MOST ADVANCED T

GH GEAR"
TRUCKS IN 20 YEARS!

Only GMC can offer contractors *all* these money-saving, money-making features in 90-inch BBC trucks: V-6 gas, Twin-Six gas and V-6 diesel power. Specially-reinforced double-life cabs. GCW to 120,000 lbs. 3-piece side-opening hood and swing-out grille sections for easiest, quickest servicing. There's a lot more. See the new Conventional Ninety-Inchers today.

This GMC 4000 Series is typical of the new '60 Conventionals. With a choice of 150, 165 and 180 hp. V-6 engines; 15 axle-transmission combinations; vacuum or full air brakes; you have all the flexibility needed to exactly meet all construction hauling requirements in the 19,500-23,000-lb. GVW range . . . the one truck that will keep job time down and profits up.

New GMC Pickups outlast all others! Rugged new V-6 gives up to 3 times longer engine life . . . saves up to 10% on gas. New rigid frames resist twisting and increase cab life. New independent front suspension and coil rear springs give a smoother ride, easier handling. Choice of 34 combinations including 4-wheel-drive models.

Under this new GMC tilt-cab is the exclusive 205 hp. V-6! One demonstration will prove the superior performance, extremely short turning and biggest safety vision. Shown is the LW 5500 Series with up to 48,000 lbs. GVW, up to 60,000 lbs. GCW. New steel tilt-cabs have a 72-inch BBC and 52-inch front axle placement to haul biggest loads. They stay on the job, are easy to service and drive.

GMC TRUCK & COACH—A GENERAL MOTORS DIVISION
PONTIAC, MICHIGAN

BIG GMC BREAK-THROUGH

in engine, chassis and cab engineering drastically cuts your hauling costs!

PULL

1. New engines that last up to 3 times longer than others!
2. New stronger, lighter frames to haul bigger loads longer!
3. New front and rear suspension! New wide track for easier maneuvering! Smoother ride and longer sheet metal life!
4. New roomier, more rugged cabs . . . complete range of BBC dimensions!
5. New "Power-Mated" drive lines with the proper gearing and strength to match every construction haul!

From ½-ton to 60-ton General Motors leads the way!

GMC
GENERAL MOTORS CORPORATION
TRUCKS

TODAY'S ONLY MODERN TRUCK CHASSIS!

NEW Springs with Longer Life and Easier Ride—GMC's standard 3-inch wide vari-rate rear springs last longer on any terrain, because they are under less stress. All braking and torque forces, normally absorbed by springs, are directed to the frame by the strong radius-rod-type leaf. New true progressive cam action adjusts the spring to the load . . . an easier ride—empty or loaded.

NEW Frames with Extra Strength and Rigidity—One look shows GMC frames are extremely rugged . . . built for the most severe construction hauls. Unique design, stronger materials and exclusive construction methods guarantee extra load-carrying ability, extra durability.

NEW Double-Life Cabs—1960 GMC cabs will stand up for many years even on the most rugged construction hauls . . . last twice as long as ordinary cabs. This great durability is the result of full double-wall construction, extra-heavy reinforcing inside the cab and special, sturdy understructure—as shown above.

FROM GMC...

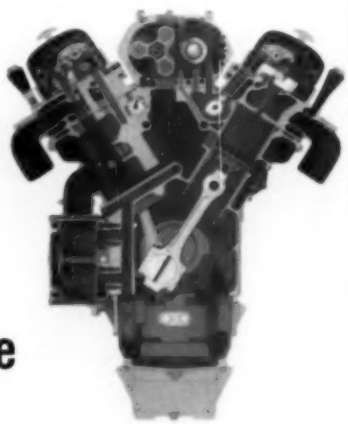
NEW GMC TWIN-SIX Most pulling power of any standard gas engine!

Now you can get 630 pounds-feet torque over an extended engine speed range! Plenty of working power and reserve power in this 702 cubic-inch power plant to get the biggest construction loads moving—and keep them rolling—with least shifting.

It's lasting power, too. Maximum governed engine speed is only 2400 rpm. This low-stress, easy-stroking speed greatly extends engine life, cuts operating costs to the bone.

Max. torque 630 @ 16-1900. Max. hp. 275 @ 2400.

NEW V-6 DIESEL Most power per dollar! lowest maintenance costs!



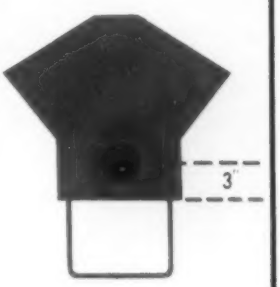
Proved, efficient 2-cycle design with power on every stroke gives you more power per dollar, more power per pound, more power per cu. in. displacement! Extra-sturdy construction and modern, simplified design keeps GMC Truck diesel engine maintenance costs far below competitive engines. Also important to cut down-time—you get complete one-stop parts and service at every GMC Diesel Truck Dealer.

189 hp. standard. 210 hp. optional at no extra cost.

NOTE: With this new, advanced 6V-71 engine, you get all the time-tested performance, economy and durability features of the famous GMC 6-71SE diesel in a shorter, lighter and more compact design.

TODAY'S ONLY TRULY MODERN ENGINE DESIGN

V·6



Full, Rigid Crankshaft Support!

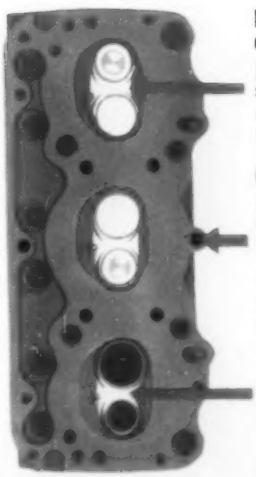
Short, rigid V-6 block has extended cast skirt that reaches 3 full inches below the center line of the crankshaft to minimize distortion and deflection, costly wear and failures.

NEW GMC V-6 ENGINES

Outlast all others! Up to 3 times longer life—proved by actual tests!

Here's why—full torque is produced at low, economical engine speeds! Full power extends over a broad rpm range! "Over-square" design, shortest stroke of any comparable truck-built engines, cuts wear and improves performance! 33% more cooling area, 3 times more water volume (up to 176 gallons per minute) eliminates all life-killing engine "hot spots"! High-volume lubrication (up to 14 gallons per minute) increases longevity!

THERE'S A NEW V-6 FOR PROFIT-PERFORMANCE ON EVERY HAUL		
Model	Max. Torque	Max. Horsepower
305A	260 @ 16-2000	150 @ 3600
305B	266 @ 12-1400	150 @ 3600
305C	270 @ 14-1600	165 @ 3800
351	312 @ 18-2000	180 @ 3400
401	377 @ 1400	205 @ 3200



Fully machined combustion chambers assure equal displacement in each cylinder for smoothest power. There are no destructive "hot spots" due to carbon build-up.

6 bolts around each cylinder (not 4) make a positive head-to-block seal and eliminate bore deflection.

Note: No two exhaust valves are adjacent. Heat concentration is prevented to extend valve life.

This widest bridge permits the best cooling, 3 times more water for faster heat transfer, greatly increased valve life.

See your GMC Truck Dealer listed in the Yellow Pages for the most advanced construction trucks in 20 years!

The New Contractor-Engineer Relationship

As we survey a new year ahead it becomes evident that a deep change that affects the entire roadbuilding art is gathering momentum. This change which will be felt increasingly is in the relationship between the engineer and the contractor. Beginning last month and in this and future issues Roads and Streets will have much to say on the subject, and comments from readers are invited.

The final purpose of highway financing, planning, design, testing and specification writing is to get quality construction with every possible economy. To this end, the highway agencies are committed to the American way. Private enterprise does the construction. Highway administrators have begun to re-examine the relationships—and the specifications and field inspection—which contribute to contractor initiative and mechanized efficiency.

Let us pause and look at this contractor-engineer set-up for a moment. A road is built traditionally under a "tug of war." The inspectors and engineers pull on the quality end of the rope. The contractor tugs on the production end. With some seesawing, the job gets done. It is under this dynamic balance that our brilliant highway art has advanced from mule scraper days.

The contractor in effect says, "We're going to move the dirt fast. We think we know the rules, but holler when we're not doing it right." The engineer, in turn, has often said in the past: "You give us *what* we want—and also do it *how* we tell you."

The Associated General Contractors of America through their highway chapters has campaigned to get some of the "how" eliminated, so that contractors can be free to improvise their own methods and apply their choice of the array of new equipment on the market. A few states have adopted "results" specifications, particularly for embankment work.

This remains however an area of controversy. Accompanying this pressure for "end results," there is need in some states for an overhauling of the internal administration of quality control on the job. The departments' inspector training effort, winter conferences, realignment of chain-of-command, and quicker testing involved, all will be reviewed in forthcoming issues of Roads and Streets.

Highway agencies and contractors are working in better harmony today. More states will be trying "results" specs. The inspection and job control from the engineers' side will be in the spotlight. Some departments still have far to go to change their specifications, adjust their attitudes, and give the contractor the green light oftener to try out new job procedures—methods that might surprise everybody. The "end results" of judiciously working with the contractors here will be lowered field engineering and inspection cost, and a better road for the public tax dollar.

The thing to remember however is that roadbuilding must remain basically what it has always been: a tug-of-war, since the contractor is geared primarily to production. The responsibilities must be kept clarified, and mutual understanding fostered.

—Harold J. McKeever

End Result Grading Specifications

Test aspects, experiences of Western contractors and engineers, and a sum-up of the case for "end results"—2nd of 2 parts

By H. K. Glidden
Contributing Editor to Roads and Streets

Highway engineers have little alternative other than to judge quality on the basis of tests performed on samples of the end-product. Guarantee clauses are seldom applicable. Test equipment and methods, therefore, are of the utmost importance in quality control.

As will be developed later in this report, fast and reliable test methods and procedures can be the greatest factor on which end-result specifications will rise or fall. Modern construction equipment and methods place embankment at a rate which makes it unthinkable that the contractor's supervisory personnel can be deprived of the results of compaction and moisture tests for even a few hours. This need for rapid results applies to both the method and the end-result specifications.

Testing Problems. Research and development work to produce more reliable and faster tests have been carried on over many years. This work has received fresh impetus from the use of end-result specifications and the stepping up of the volume of construction work due to the Interstate System. The situation existing today was well summed up by F. N. Hveem, materials and research engineer, California department of highways, in an informal statement as chairman of the Material Session of the 1959 WASHO conference in Billings, Montana. He said, "Many tests are inadequate. We must find artificial means of reproducing what occurs in nature."

One of the complications in interpreting compaction test results is illustrated by the statement in a paper at the same WASHO conference by L. F. Erickson, materials engineer, Idaho department of highways, "How many of you have computed the sample size ratio on earthwork for a single density test? A 10-lb. sample of soil taken for a density test is large, at least by Idaho standards, and I believe it is in most states. A soil weighing 100 lb. per cu. ft. means that this sample is 1/270 cu. yd. Should a density test be taken for each 1,000 cu. yd. placed, the sample is then a 1/270,000th part of the material placed. Quite often the sample may weigh only 5 lb., representing a one/half-millionth part. Can we say that such a small sample is truly representative of the entire mass?"

Fast and adequate testing has two drawbacks. The older test methods are time consuming. Newer test equipment is usually costly.

Another phase of the problem of testing was stated by Mr. Erickson in the same paper as follows: "Any inspector today has his hands full. He must observe the work in process; he must be capable of quickly performing the necessary tests; and he must, above all, use sound judgment in his handling and controlling material on the project. New men can be taught test procedures and methods, but only time can give them sound judgment in applying the results."

Test Equipment. The discussion of test equipment will be limited to those items found on the job in the four states referred to. The pieces of equipment include the sand-

Is a rubber-tired supercompactor permitted? On this Wyoming project the contractor had a completely free hand under the new results-type highway grading specifications.

cone, Washington Dens-O-Meter, Nuclear nondestructive equipment, Speedy Moisture Tester (a device for determining moisture content by the use of carbide), Quick Drive Cup and the 50-ton proof roller.

The sand-cone method is adequately described in AASHO publications, and has been in use for a number of years.

Testing for moisture content by the use of carbide is a relatively new development. Wyoming has six 6-gram Speedy Moisture Testers; manufactured by the Alpha-Lux Co., Inc. This equipment consists essentially of a pressure vessel and a pressure gauge. The principle of operation relies on the gas pressure resulting from the chemical reaction of carbide and moisture. Any given quantity of moisture will produce a given pressure. The equipment is calibrated so that moisture content can be determined from the reading of the pressure gauge. This equipment is available in two sizes (6 and 26 gram samples). The basic cost to Wyoming was $160 per small unit, $225 for the 26.

Segment wheel rollers are growing in popularity in states where the contractor is permitted to use them to best advantage. This Buffalo-Springfield Kompactor here proved an efficient compaction tool.

The Washington Dens-O-Meter is described in Highway Research Bulletin No. 93 and in ASTM Procedures for Testing Soils, 1958 edition. This device costs about $340.

Nuclear test methods and equipment with their promise of very rapid determinations were reviewed in *Roads and Streets** and will not be detailed here. In the panel discussion of L. F. Erickson's paper at the WASHO Billings conference, cost of nuclear equipment from Nuclear Chicago was estimated at $4,000 to $5,000.

Wyoming has developed a device, the Quick Density Drive Cup. It incorporates a cylinder of known volume which is hammer-driven into the embankment to obtain an undisturbed sample. By subtracting the cylinder weight from the gross weight of the filled cylinder, the weight per cu. ft. of the compacted soil is obtained. Moisture content can also be determined by oven drying the sample.

The device provides a fast method of obtaining a sample of known volume. This equipment is made only on order and is not commercially available.

The various 50 ton, and over, pneumatic rollers are test equipment in the sense of proof rolling. Presumably any embankment area that will support one of these rollers is adequately compacted. They are useful in ferreting out soft spots.

Colorado Testing. Colorado currently uses the sand-cone method as described by AASHO. Their use of the Washington Dens-O-Meter and Nuclear Chicago equipment has been limited to laboratory testing. The laboratory is in the process of performing correlation tests, but to date do not have enough data to come to any conclusive decision. W. J. Walsh, construction engineer, states that the sand-cone method has proved satisfactory. He is of the opinion that the Nuclear Chicago testing device has great potentialities, particularly in base courses. He reserves his final judgment until after more-on-the-job use.

Wyoming Testing. Wyoming has an active program to correlate and evaluate the Nuclear Chicago, Speedy Moisture Tester, Quick Density Drive Cup and sand-cone methods.

I. E. Russell, materials engineer, reports that while the sand-cone is standard field procedure, the Quick Drive Cup is used at the same time to secure additional samples in the same test area.

Russell also reports that if field and laboratory tests confirm the value of the Speedy Moisture Tester that they plan to purchase about forty 26-gram testers for field use.

Idaho Testing. Idaho testing is summed up in the following paragraph taken from L. F. Erickson's WASHO paper. "One method suggested for proving satisfactory densification of earthwork is by the use of a 50-ton compactor to proof-roll a subgrade. However, this method does not prove adequate compaction of an entire embankment. Other new equipment used includes the Washington Dens-O-Meter, which we believe to be a very excellent instrument for this purpose, and the best we have tried for granular materials. Our standard method is still the sand density test."

In discussing this subject with Mr. Erickson he advised that Idaho is getting good job control under end-result specifications, but that it has required more help. He states that it is not unusual to run as many as 2,000 density tests on one major project.

Washington Testing. The Washington Dens-O-Meter is standard equipment for determining the volume of embankment test samples.

Continued on page 96

*"Better Compaction Control with Nuclear Test Methods," by H. A. Radzikowski and N. J. Cohen, Bureau of Public Roads, Roads and Streets, July, 1959.

1960 Outlook: After a Bad Year, a Snap-Back

Spurt in state road awards expected in 1960 first half, as federal money flow for jobs is loosened.

By Duane L. Cronk

Director, Highway Information Services, Inc., Washington, D.C.

"The best thing you can say about 1959 is: 'Thank heaven, it's over!' "

That's how one East Coast roadbuilder put it. As a head of a good-sized contracting outfit, doing work in four states, he probably spoke for a number of his fellow businessmen. Calendar Year 1959 saw the steeply climbing state highway award volume falter and sink at least 22 percent under the record-breaking 1958 level. Uncertainty over the availability of future federal aid began to cloud state highway department plans early in the year. Then, as Congress stalled for six months, state after state scrapped its contract schedule and the highway contracting market went ker-plunk.

The industry is still wary. But a cross-country check of contractors and highway officials as the year comes to a close, finds the outlook for 1960 definitely brighter. It might be a good idea to take a final look back over the shoulder at the disappointment called 1959, and a quick look at the new year, to keep a number of vital business elements in perspective.

What are the factors which hurt the highway contracting business last year? Has their influence diminished? What about materials, costs, equipment prices, and labor costs? How about competition? How much money will there be for construction in 1960? Why do industry leaders now believe that the next 12 months, particularly the next 6 months, will see the roadbuilding market regain its upward climb? This preview, confined to state road programs, gives the best available answers.

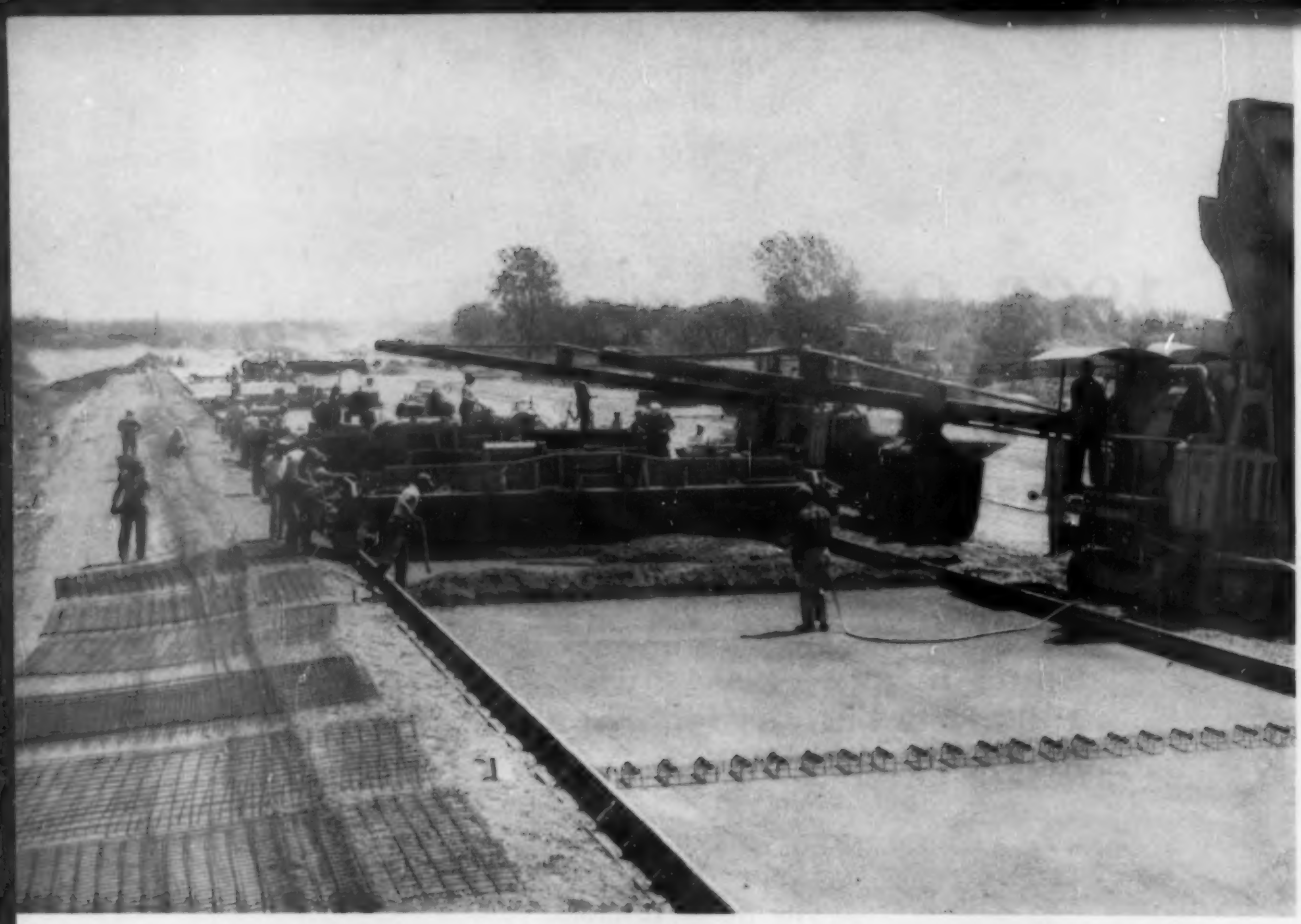
In 1959: Last year saw the annual total of contract awards turn downward for the first time since the inception of the National Highway Program in 1956. As Congress dallied over a new federal gasoline tax to replenish the diminishing Highway Trust Fund, state highway officials cut construction schedules, and the flow of new work dribbled to a stop in a number of states.

Figure 1 shows in graphic form what happened to state highway department contract volume, nationwide, during calendar 1959, compared with the record-breaking 1958.

The total of all state highway department construction contract awards for calendar 1959 was an estimated $3,159 million, compared with $4,056 in 1958 according to BPR. These figures compare with $3,017 vs. $4,498 million (see table on pages 124-125), the latter total apparently reflecting some late items in the states' records.

In 1960: The worst is over. The Bureau of Pub-

Continued on page 120



Vibration is most effective when the subbase moisture content is such that a film of water is flushed to the surface.

Getting Quality Construction

One of a Series

Uniform subbases compacted to a high density pay off in improved pavement performance.

Practice Sum-Up: Subbase for Concrete

By John D. Geesaman
Field and Laboratory Studies Engineer,
Portland Cement Association

The first steps in the construction of a smooth-riding pavement must be taken long before the paving equipment appears on the job.

As highway traffic continues to increase in volume and weight, the need for providing uniform pavement support becomes more and more critical. The quality of subgrade and subbase construction has more effect on the future performance of the pavement than the type of subgrade soil or the type, width and thickness of the subbase.

Uniform Subgrade. Where soils vary widely in texture, the placement of the more desirable soils in the upper portions of embankments by selective grading and cross-hauling is an effective and widely used method of obtaining uniform subgrade conditions. With modern construction equipment, the mixing of nonuniform soils is often more economical than long hauls from borrow pits of selected material.

When cohesive soils are compacted at or slightly

Soft spots located by proof rolling should be excavated and recompacted or replaced.

Subgrades which have been exposed for a considerable time should be loosened to a depth of 6 in. and recompacted at the proper moisture content.

above their standard optimum moisture contents (AASHO-T99) the subgrade retains the stability imparted to it by compaction. Moisture movements within these soils are reduced to a minimum when they are compacted at this moisture content and they have greater resistance to expansion, frost action and softening caused by excess moisture.

If the subgrade is too wet at time of construction, construction traffic will cause rutting, subgrade soil will be mixed into the subbase material and the subbase will not be properly constructed. However, if the subgrade is too dry, it will become unevenly wet and soft during the first heavy rains after paving. The moisture content will increase more rapidly at the joints and at the pavement edges, which will result in uneven support at these locations and possible early pavement damage.

When the subgrade is constructed a considerable time prior to subbase and pavement work, there may be changes in its moisture content. In such cases the upper 6 in. should be loosened and recompacted at the proper moisture content before the subbase is placed.

As a final check for subgrade uniformity, soft spots should be located. This is often done by proof rolling with 30- to 50-ton rubber-tire rollers. (These "supercompactors" should not be used for the rapid compaction of dry subgrades.) Uniform support cannot be obtained by merely dumping extra granular material at soft spots. The subgrade at such locations must be excavated and recompacted at the proper moisture content. If a soft spot consists of a pocket of soil which has sharply different properties from the surrounding soil, it should be replaced with the same type of soil as the adjacent subgrade.

Subbase Compaction. Granular subbases are susceptible to consolidation from the vibration of traffic on the pavement. The compaction of granular material to uniformly high density during construction is extremely important, in order to prevent a detrimental amount of consolidation from occurring after the pavement has been placed in service. The subbase should be compacted to as high a density as practical and no less than 100 percent of standard AASHO density.

Moisture-density relationships vary widely among granular materials. The moisture content at which high density is most effectively achieved depends on the material and the type and weight of the compaction equipment. Generally additional water will be required. If the water is added on the grade

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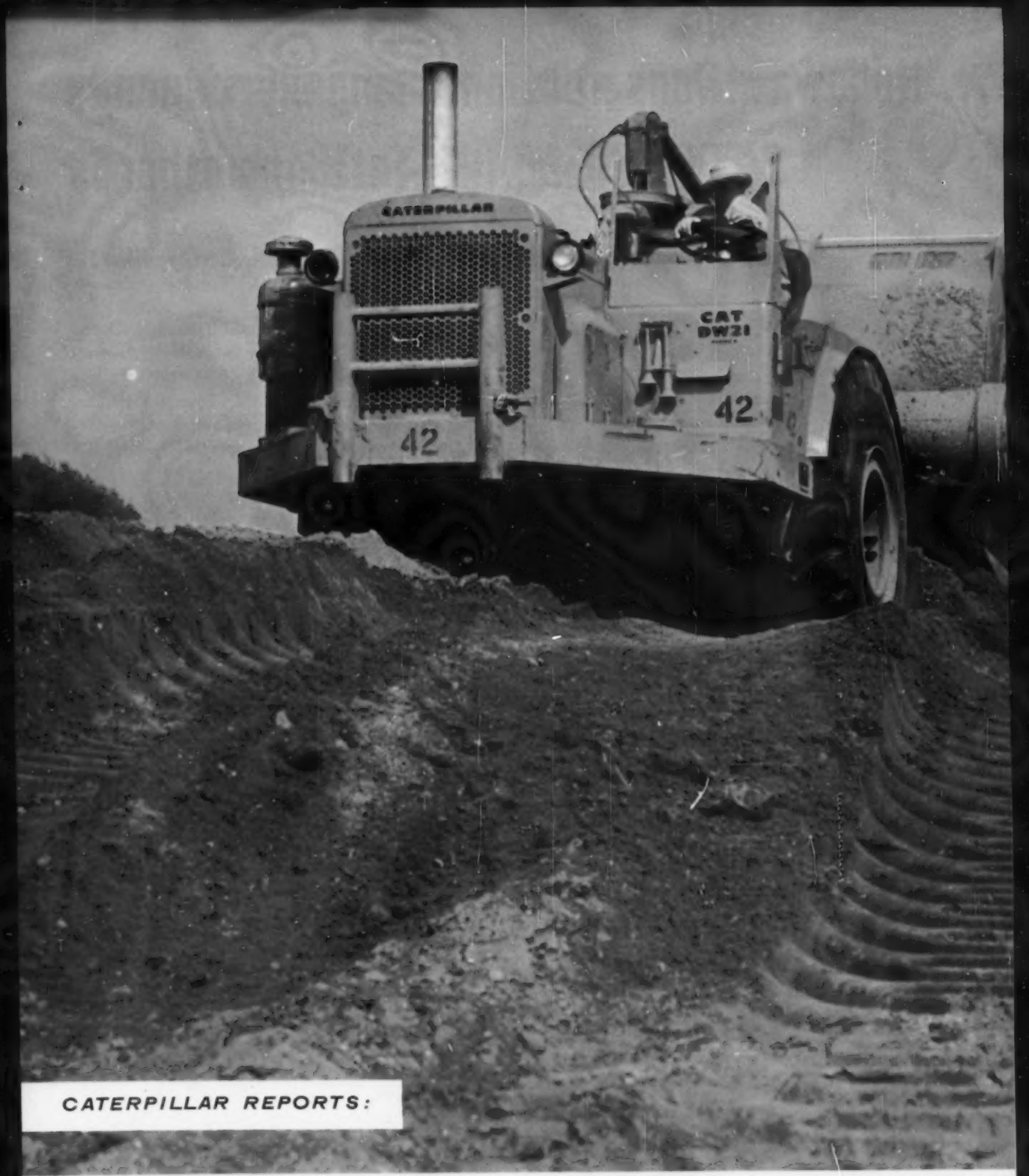


CATERPILLAR REPORTS:

THE BIG STORY BEHIND THE BIGGEST EARTHMOVING JOB IN MICHIGAN...

Holloway Construction Company depends 6,000,000 cu. yd. in 16 months on

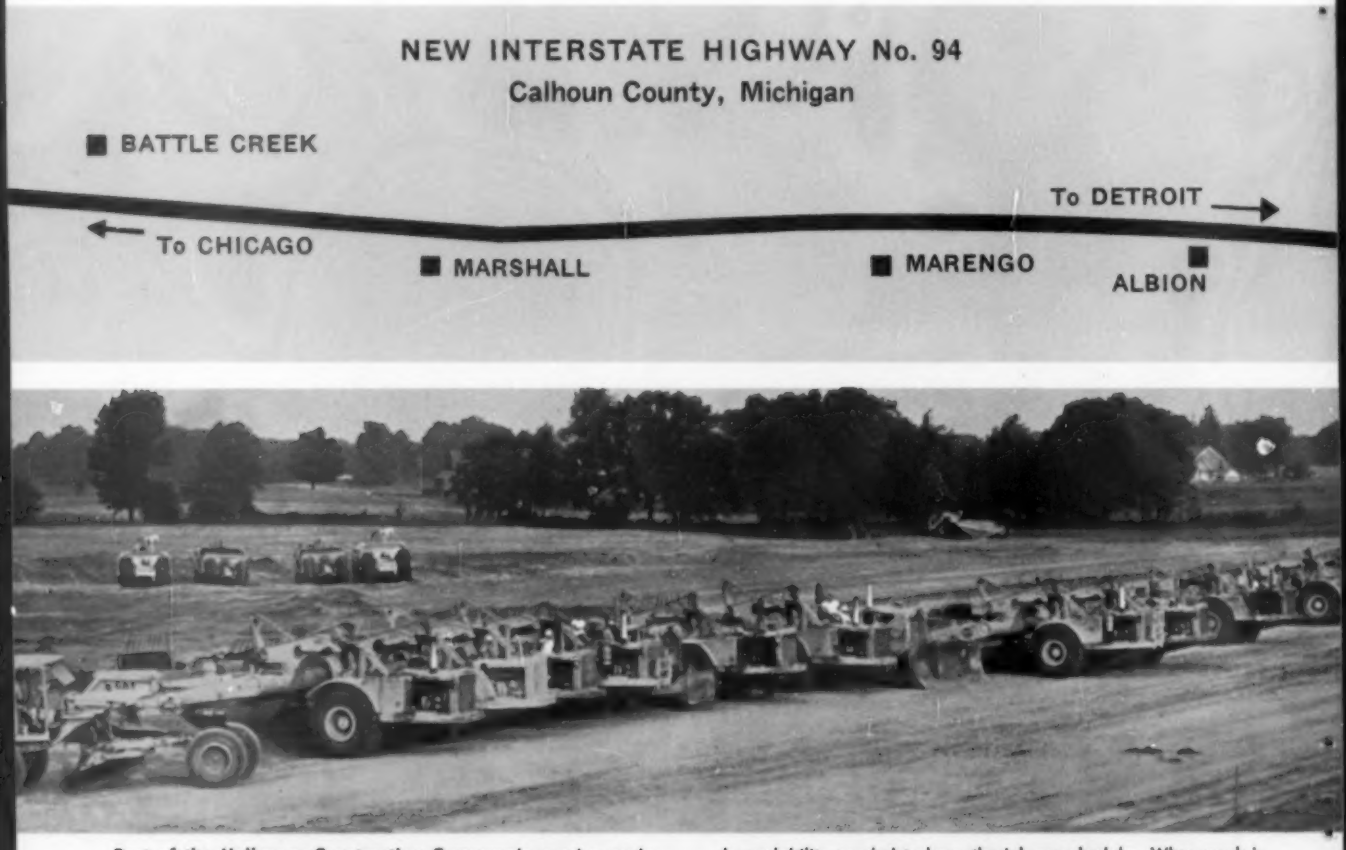
Michigan contractor's giant highway spread is 95% Caterpillar!

From Albion to Battle Creek, 6,000,000 cu. yd. of sand, clay and muck are being moved to speed traffic over the rugged hills of south central Michigan. In the largest earthmoving job ever handled by a single contractor in the state, curving U. S. 12 is being converted into 21 miles of Interstate 94.

Midway between these two cities you can stand with your feet planted deep in the soft, brown clay and look in either direction, as far as the eye can see, at the army of yellow Caterpillar machines carving out the path of this new roadway.

The Holloway Construction Co. of Livonia, Michigan, won the $8,500,000 contract by being low bidder on three continuous segments of the project. Work started on April 1, 1959, and is due for completion by August 3, 1960. As of the latest report, according to Bud Morrell, Job Supt., production was running 10 months ahead of schedule.

To keep pace with the demanding schedule, men and equipment are working a steady 11 hours every day. And the Holloway spread—twice as large as any other assembled by one contractor in the state—depends heavily on Caterpillar quality to maintain this high-production capacity.



Part of the Holloway Construction Company's massive equipment spread that is now working on Michigan's biggest earthmoving job. 95% of the machines are Caterpillar-built, assuring the dependability needed to keep the job on schedule. When work is completed, Interstate No. 94 will be one of the key routes between Detroit and Chicago.

on Caterpillar machines in moving 21-mile Interstate Highway project

There are 66 Caterpillar-built machines operating on the job including:

40 DW21 Tractor-Scrapers

8 D9 Tractors	**2 D4 Tractors**
8 D8 Tractors	**4 No. 12 Motor Graders**
2 D6 Tractors	**2 No. 14 Motor Graders**

For successful contractors throughout the country like Dan Holloway, there is only one reason for using Caterpillar equipment: "I think Caterpillar is the best equipment made in terms of high production and low cost of operation."

This, indeed, is the big story behind Michigan's biggest earthmoving job.

Gamma Rays speed soil compaction tests. This new device, developed by the Michigan Highway Department, determines compaction as well as moisture content. In two minutes it can perform work which takes a half hour by conventional methods.

High-speed loading of DW21s with Cat D8 and D9 pushers is clearly visible in a borrow pit several miles north of Marshall, Michigan, one of the towns to be bypassed by the new highway.

WHAT THE MEN WHO KNOW MACHINES HAVE TO SAY ABOUT CATERPILLAR-BUILT EQUIPMENT:

Francis "Bud" Morrell, Job Supt., Holloway Construction Co. "You can count on Caterpillar. When you take a big job, you must be sure that your equipment is going to stay on that job. We take care of our machines, work them like hell, and know that these Caterpillar machines take good care of us."

George Neely, Equipment Supt., Holloway Construction Co. "We like Caterpillar machines because they are better than any other make. We've tried them all at one time or another, but these other manufacturers have a long way to go before we change our minds on which equipment is the best."

Dan Holloway, Owner, Holloway Construction Co. "Caterpillar machines make more money for us. They stand up under 12-month-per-year punishment. Last December we moved one million yards of dirt in 28 days. We had to keep after it day after day to prevent it from freezing."

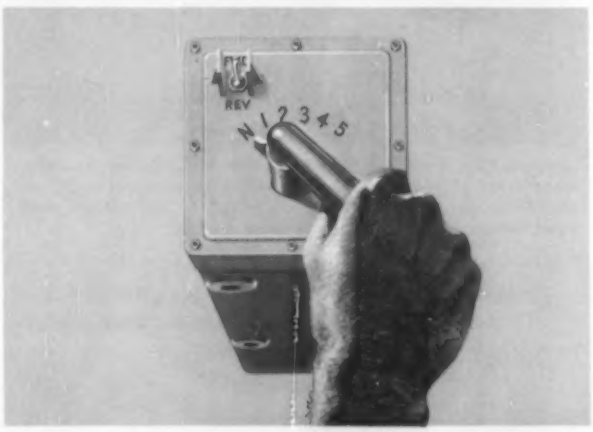
Russ Hill, Master Mechanic, Holloway Construction Co. "When a machine goes down, you have to move fast to get it back on the job. We want the right part fast. Michigan Tractor (Caterpillar Dealer) takes good care of us. When a part is guaranteed, you know they'll back it up."

NEW PRODUCTS FROM CATERPILLAR SET NEW PRODUCTION STANDARDS

Here's a review of 3 important product developments born of Caterpillar research . . . proved in the field . . . available to you now for higher production

New 225 HP Cat No. 619 Tractor and 14 cu. yd. No. 442 Scraper

First two-wheel tractor to deliver four-wheel speed and dependability . . . matched with new No. 442 Series B LOWBOWL Scraper for new high production. The new No. 619 with Turbocharged Cat Engine provides 225 HP and high torque rise, ideal for lugging under load and fast acceleration. Its LOWBOWL Scraper handles 14 cu. yd. struck, 18 cu. yd. heaped. It has a 30.2 MPH operating speed, plus ground-hugging roadability never before found in a two-wheel tractor of comparable size. It is a versatile "all job" rig.



SynchroTouch Transmission Control for DW20 and DW21 Tractors

An advanced new way to shift gears easier and faster. Operator simply dials desired gear for automatic, split-second, touch-and-go response! In less than a second, it is engaged. Standard foot clutch is retained but is used only starting from standstill.

Optional for DW20 and DW21 Tractors, the Caterpillar SynchroTouch Transmission Control gives you these important benefits: 1. Faster shifting—for faster cycles and more payloads per hour. 2. Significant reduction in operator fatigue. 3. Economical direct drive transmission—uses standard DW20 and DW21 transmission and clutch components. 4. No special maintenance.

Power Shift Transmission for D8 and D9 Tractors

On-the-go shifts under full load in a split second. Changes speed, reverses direction with finger-tip control lever—and no clutching! This new transmission, with exclusive new design, provides production highs never before possible with a track-type tractor.

Power shift control is mounted to operator's left. Selector lever (black knob) eliminates gearshift, forward-reverse and flywheel clutch levers. Safety lever (red knob) prevents accidental engagement. Selector lever moves in a "U" path to various positions.

See your Caterpillar Dealer for the complete facts. Ask him to demonstrate these new product developments on your job.

Caterpillar Tractor Co., General Offices, Peoria, Illinois, U.S.A.

CATERPILLAR

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DIESEL ENGINES • TRACTORS • MOTOR GRADERS
EARTHMOVING EQUIPMENT

GREAT NEW PRODUCTS IN THE CATERPILLAR TRADITION

One of several types of rolling units finding favor with contractors because of ability to produce required densities in fewer passes and handle more yards per day. The specification writer's problem is to see that such units have the "green light".

Progress Report: Highway Compaction Control

By H. A. Radzikowski

Chief, Division of Development, Office of Operations,
Bureau of Public Roads, Washington, D. C.

No part of road building has a greater influence on the life and serviceability than the compaction of embankments and the base and pavement layers. Scientific knowledge and construction techniques have advanced in the last 25 years; however, a fuller and more practical solution to the compaction problem is desirable.

Modern earth compaction or "controlled compaction" had its beginning within the memory of many practicing highway engineers. It had its inception in 1933 when R. R. Proctor of the Los Angeles Bureau of Waterworks and Supply, developed testing equipment and methods for determining the moisture and density characteristics of various soils which provided the greatest stability and watertightness.

Current tests T-99 and H-180 of the AASHO for the moisture-density relationship of soils are based on Proctor's original work.

These tests and their relation to a field in-place density test, AASHO T-147, form the basis for present standards. To date these standards as established for embankment density have had considerable influence in the design and application

Can the contractor roll with supercompactors? Some states still hamper the contractor in making such decisions on rolling methods.

of compaction equipment. Most such developments are designed with the aim of providing specified densities with the fewest number of passes.

Current Density Requirements for Embankments: Presently all 50 state highway departments and those of Puerto Rico and the District of Columbia require a minimum density for embankments compacted by controlled methods. Forty-five departments base requirements on a percentage of the values obtained in AASHO T-99. Four base requirements on AASHO T-180, a modification requiring greater densification than T-99. Three departments base requirements on their own test procedures.

On the face of the record, acceptance by 45 departments of a standard method for testing embankment supporting value would seem to promote uniformity of requirements. However, on examining the ranges of percentages specified and other modifying requirements, it becomes apparent that there is a lack of agreement on common denominators—and even in basic concepts—of soil behavior under highway loads and prevailing weather conditions.

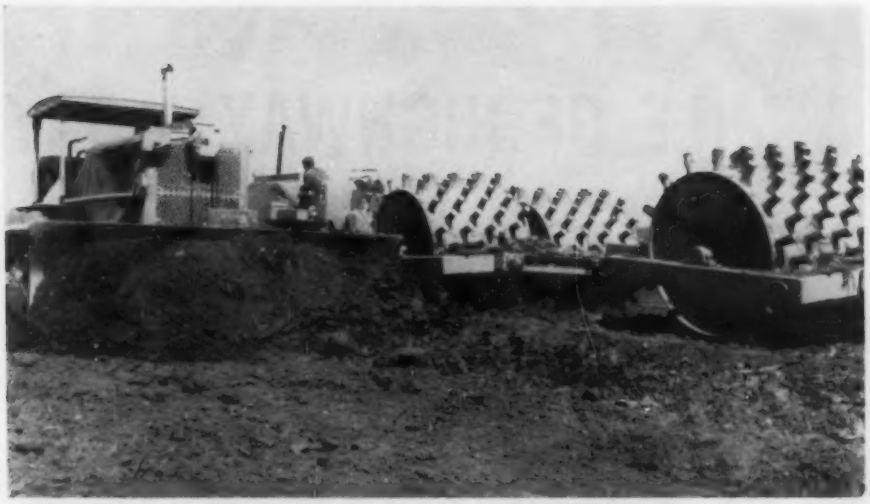
About one-third of the states specify a percentage of 95 based on AASHO T-99 for all soils, without any qualifying provisions. Another four specify 90 percent for all soil conditions. The four which employ AASHO T-180 specify 100 percent for all soil types. There is some question whether the same degree of supporting value or resistance to settlement is expressed, when a single percentage such as 95 is specified for both fine grained and coarse grained soils. To illustrate, 18 states favor sliding density requirements, such as 90 to 95 percent or 95 to 100 percent, based on soil classification.

Here again there is no unanimity of opinion as to whether the range should ascend or descend as the soils change from coarse grained to fine grained. Twelve states increase the percentage of maximum density as the soils become *finer,* apparently on the basis that the soils with the least bearing power need the most compaction. Six states increase the percentage of maximum density as the soils become *coarser.* This is with the thought that granular material will settle under traffic vibration, if not compacted to a high degree, and that over-compacted fine grained soils will swell when subjected to additional moisture. Such major differences in basic concepts should be resolved.

Seven departments specify varying densities based on the depth of the layer below the subgrade. With one exception the density requirements in the upper lifts are greater than in the lower lifts. The excepted state takes into consideration the densification needed to suport surcharges of 20-ft. depth and greater.

Methods for Density Determinations: Laboratory methods AASHO T-99 or T-180 are similar to the test method established by Proctor to define a peak or "maximum" density obtained from moisture-density relations. The original conception related this "maximum" density to a condition of greatest stability. Recent laboratory studies show that a decrease in stability can occur in some lean clay soils with a corresponding increase in density. Therefore, it appears necessary to develop a new criterion which correlates stability, load supporting capacity and density.

Field in-place density methods currently in use are varied. Most popular is the calibrated sand-cone method, by which density of soil in the natural state or after compaction in an embankment may be determined by finding the weight and moisture content of a disturbed sample, and measuring the volume occupied by the sample prior to its removal.



Specifications still vary between the states as to details of sheepsfoot roller weight, drum size, foot dimensions, and unit weight on feet required or permitted.

A similar procedure of establishing a volume-weight relationship by the use of oil or sand in AASHO T-147 method is also practiced. Test apparatus for this method differs from that used in the calibrated-sand-cone method.

Finally, density may be determined by the extraction of undisturbed samples in driven cylinders or cubical containers of known volume. The soil weight and volume occupied by the sample establishes the wet soil density.

Laboratory Methods: Limitations for AASHO Methods T-99 or T180 in determining laboratory compacted "maximum" density are as follows:

(1) Establishing a moisture-density curve by dynamic impact tests such as T-99 or T-180 is time-consuming, often requiring 4 to 6 hours to find a "maximum" density.

(2) Dynamic impact types of compactive energy are not always a true representation of the type of energy used during field compaction. For example, rubber-tired compactors exert a static or dynamic kneading type of compactive energy. Under such conditions, measurement of the degree of compaction in the laboratory by an impact type of test does not necessarily reflect the degree of compaction achieved under actual construction conditions.

(3) AASHO T-99 or T-180 test methods are not applicable to all soil materials. Some base courses consist of gravel or crushed stone greater than a 1-in. size aggregate. These materials obviously do not lend themselves to the determination of a laboratory "maximum" density by T-99 or T-180 test methods.

(4) An increase in compactive effort such as that obtained in specifying AASHO Test T-180 instead of T-99 is generally thought of as a means of increasing soil density. Experience has shown this is not always the case for coarse sand soils containing less than 10 percent passing the No. 200 sieve.

Field Methods: (1) Conventional field density tests are time-consuming. Results of these tests can be determined within 20 minutes to an hour or more, depending on facilities available.

(2) Conventional field density test procedures require man's skill and experience to consistently perform the basic steps necessary in determining field density.

(3) Conventional field density tests uses a procedure which disturbs the soil structure, thereby creating inaccurate results.

(4) Conventional field density test methods are not practical for large sized base course aggregates or for frozen soil materials.

A new nuclear test instrument capable of determining density and moisture content on the same device during highway embankment compaction has been developed by the Michigan state highway department. The nuclear gage employs a Radium-226-Beryllium radioactive source mounted in a stainless steel casting approximately 10 in. square and 2 in. thick which rests upon the ground surface for a density or moisture determination.

This test is a non-destructive method whereby the radioactive source produces a radiation of gamma and neutron rays into the material to be measured. These rays are partially absorbed and partially reflected. Rays reflected pass through Geiger-Muller counter tubes in the surface gage, and then are amplified and transmitted through an electronic circuit. Counts per minute are read directly on a reflected ray counter gage. Counts per unit of time are related to density and moisture by means of calibration curves.

Advantages of Nuclear test method: (1) Non-destructive and does not disturb soil structure.

(2) Eliminates the several conventional field test

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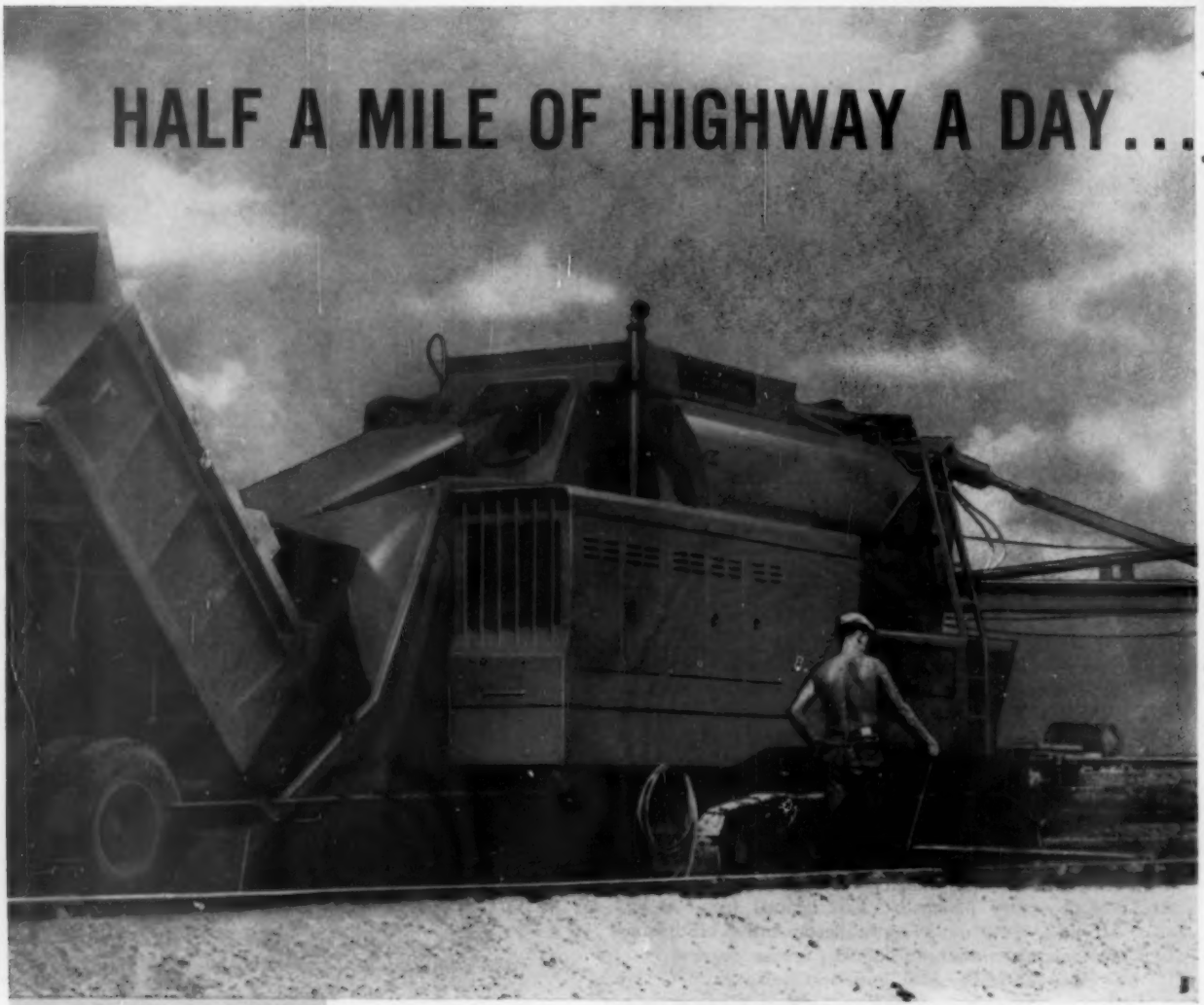
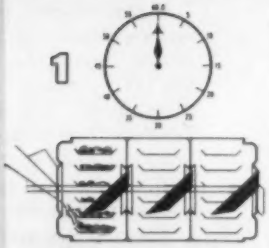
HALF A MILE OF HIGHWAY A DAY...

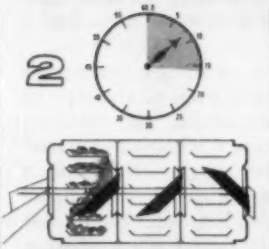


3-COMPARTMENT DRUM PRODUCES APPROX. 2 BATCHES OF CONCRETE (74.8 CU. FT.) EVERY MINUTE

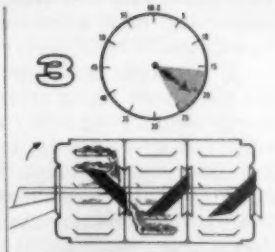
Note: Shaded area of clock shows interval of time required for each portion of mixing cycle illustrated. Arrow shows half-way point of elapsed time in each step. Position of transfer chutes, discharge chute, material, etc., is shown for that particular instant in the mixing cycle.



Skip raised automatically by Batchmeter (after release of safety device by man directing batch trucks into skip) . . . water starts into drum automatically . . . dry material flows into #1 compartment . . . Batchmeter set . . . mixing cycle begins at 0 seconds.



First batch mixing in #1 compartment . . . skip down, batch truck depositing material in skip . . . water-measuring tank being filled from supply tank.



First batch being mixed and transferred from #1 compartment to #2 compartment . . . skip starts up automatically (after safety release) with dry material for 2nd batch . . . water-flow for 2nd batch starts automatically as skip raises.

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TRIBATCH

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43% MORE OUTPUT

with no change in your present batch plant, trucks, finishers

Size-wise, the 34-E TRIBATCH fits right in with your present paving spread — no need to modify or change existing batching, hauling, spreading, finishing equipment. (Only exception would be additional batch trucks, depending on length of haul.) Secret of high TRIBATCH output is in the continuous "assembly-line" production of its 3-compartment mixing drum. Here's the difference:

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	34-E TRIBATCH	34-E dual-drum
Cycle time:	29 sec.	41.5 sec.
Batches per hour:	124	86.7
Yards per hour:	172	120

Consider what this 43% production increase can mean in your 1960 profit margin. Better be ready to *go* with a 34-E TRIBATCH. Call your Koehring distributor, or write today.

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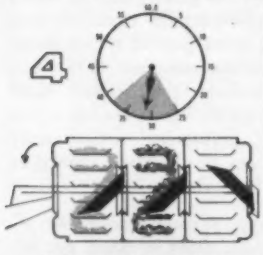
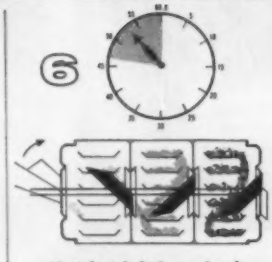
DIVISION OF KOEHRING COMPANY
Milwaukee 16, Wisconsin

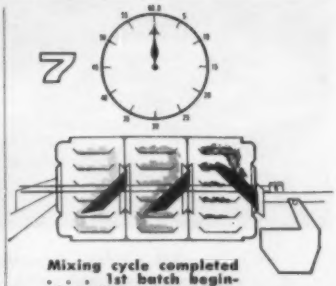


First batch being mixed in #2 compartment . . . 2nd batch being mixed in #1 compartment . . . skip is being lowered to receive additional material . . . water measuring tank is being filled from supply tank.

First batch being mixed and transferred from #2 compartment to #3 compartment . . . 2nd batch being mixed in #1 compartment . . . skip down, batch truck dumping material in skip . . . water-measuring tank being filled from supply tank.



First batch being mixed in #3 compartment . . . 2nd batch has just finished transfer to #2 compartment and will continue to be mixed there . . . skip coming up for introduction of 3rd batch into #1 compartment . . . water-flow has just begun for 3rd batch.



Mixing cycle completed . . . 1st batch beginning discharge from drum into bucket . . . 2nd batch mixing in #2 compartment . . . 3rd batch mixing in #1 compartment . . . skip down ready to receive dry material for next batch . . . clock reads 60 seconds!

To: Koehring Division
3026 W. Concordia, Milwaukee 16, Wis.
Send: ■ bulletin ■ spec. sheet on 34-E TRIBATCH

NAME _____ TITLE _____
COMPANY _____ DIV. _____
STREET _____
CITY _____ STATE _____

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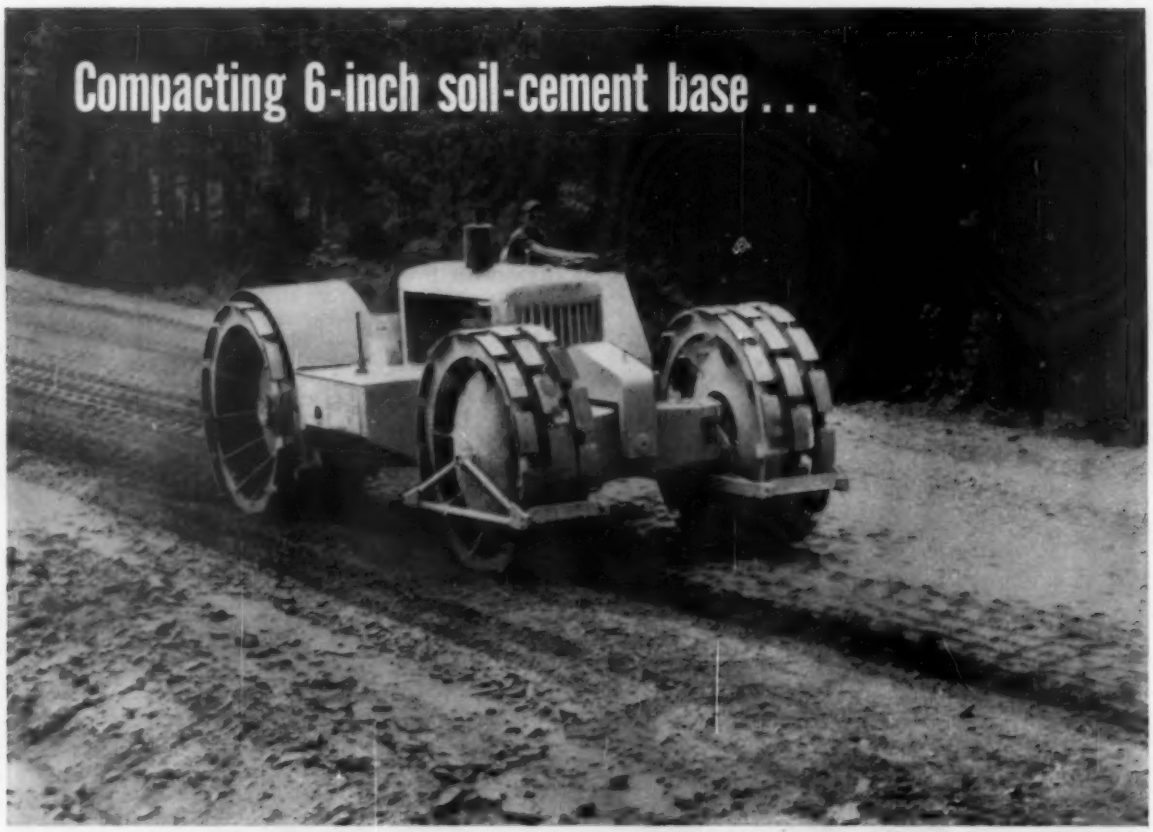
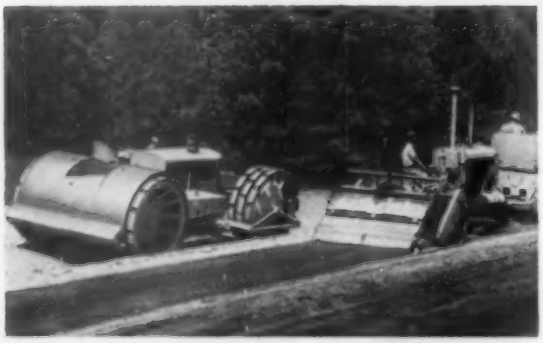


. . . K-45 KOMPACTOR averages 3,000 lineal feet per day



A smooth-running job

All mixing, compacting, paving operations are closely coordinated. First, bulk cement is spread on grade. Next, tractor-drawn pulverizers (above) make a "dry" pass over roadbed, mixing cement with soil. Then, a second pass is made re-mixing soil-cement and adding water. Next comes segmented Kompactor to compact the mixed soil-cement. After 3-day curing time, paving crew moves in, applies surface coats.

Construction of stabilized soil-cement base required careful timing on this road paving project. Two pulverizer-mixers, cutting to a depth of 6 inches, mixed soil-cement on the grade, adding water on the final pass. High compaction densities had to be obtained fast, during brief period while materials retained proper moisture content. This was no problem with a big Buffalo-Springfield® K-45 Kompactor® on the job. Operating at speeds up to 5 mph, this self-propelled, segmented roller easily kept up with the pulverizers . . . helped complete 3,000 feet of soil-cement base daily.

The K-45 applies a unique, "interrupted-pressure" action that meets required densities in sand, gravel, clay, common earth, etc., in fewest passes. Staggered rows of individual steel pads on giant roller wheels exert *all* compaction effort *downward,* give uniform density of fill from lower elevation to top level. Check Kompactor performance. See how *you* can get better compaction in less time, at lower cost. Call Buffalo-Springfield distributor today.

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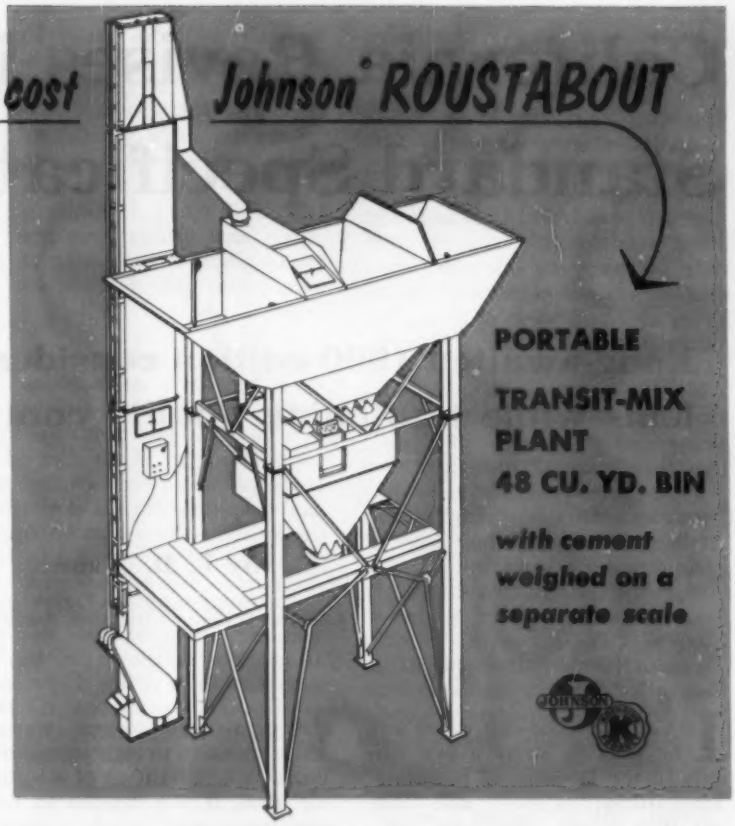
Meet the NEW...low-cost Johnson® ROUSTABOUT

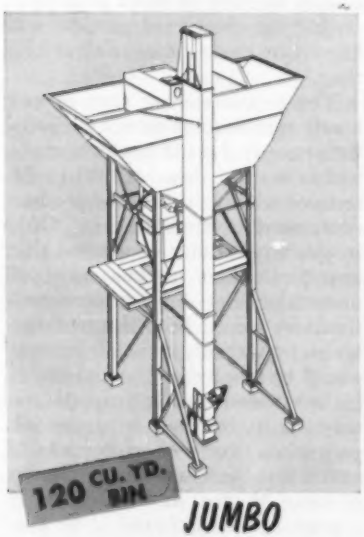


Latest development in a completely new series of low-priced transit-mix plants, this Johnson *Roustabout* is as portable and rugged as its name implies! Everything about it is designed for quick, easy assembly, and convenient truck transport between jobs. Maximum width of largest plant section is only 9 feet — maximum erection lift, only 4½ tons. Plant is set up, ready to work in less than a day's time!

Handles 4 materials — All-welded, 48 cu. yd. bin has 3 aggregate compartments (with total heaped capacity of 38 cu. yds.) — and a 60-bbl. cement compartment. Built-in, ¾ h.p. air compressor aerates cement through built-in fittings and plug-in connections. 180-bbl.-an-hour cement bucket elevator has 3 h.p. gearmotor with roller chain drive, and boot hopper for bulk or bag cement. Electric control panel is included, with plug-in connections to all plant motors.

Meets rigid specifications — One of the big *plus* values of this Johnson *Roustabout* is *separate weighing of cement* — complies with the most exacting mix specifications on paving and structural concrete jobs. A 3 cu. yd. Concentric aggregate-cement batcher, usually found only in larger more expensive Johnson plants, is *standard equipment* in the low-price *Roustabout.* It's manually-operated — and weighs the cement on an *independent* scale, separate from aggregates. Centrally located, sealed hopper discharges cement *within* the aggregates. This minimizes dusting, and *pre-mixes* all materials as they flow through discharge.

Roustabout is well-suited for clam-shell charging — has large aggregate bin openings. Charging height is only 30½ feet. It also can be equipped with belt conveyor or bucket elevator for aggregates — and auxiliary storage silo with undertrack screw conveyor system for cement. Other optional accessories: bin signals, water meter, special hoppers, etc. Better see your Johnson distributor about the *Roustabout* right away — or mail coupon.



JUMBO

Largest in new Johnson series of low-cost packaged transit-mix plants, the *Jumbo* has bin storage for 3 aggregates (105 cu. yds. tot. agg. cap.) and 110 bbls. cement. 3-yd. or 6-yd. Concentric batcher.

ECONOPLANT™

Rounding out this special, low-priced transit-mix line, Johnson *Econoplant* handles 3 aggregates (tot. 45 cu. yds.) plus 70 bbls. cement — has all-welded bin, low 30½ ft. charging height, 3-yd. Concentric batcher.

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Send us details on: ☐ Roustabout ☐ Econoplant ☐ Jumbo

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California Revises its Standard Specifications

Long-awaited 1960 edition considers contractors' problems while tightening quality control in many places.

By L. D. Wanee

Assistant Construction Engineer,
California Division of Highways, Sacramento

In California the contractors will be working under a new edition of the Division of Highways' Standard Specifications. The January 1960 edition culminates many months of effort which included collecting, analyzing, eliminating, and revising suggestions for changes in the August 1954 Standard Specifications.

In the recent past, to bring the specifications for each project in line with the most modern practices, the division has used what are termed "Standard Special Provisions." These were revisions of the Standard Specifications, or additional specifications not contained in them. Applicable standard special provisions inserted in the book titled "Special Provisions and Contract," printed for each project.

Additions to these standard special provisions made on a continuing basis as the need arises. After issuing the 1954 specifications, as time went on, eventually the volume of standard special provisions used on each project became so great that many of the "special provisions" books were reaching unwieldy proportions. The time had come to bring the 1954 specifications up-to-date, and the state's districts were asked for revision suggestions early in 1958.

Headquarters construction department personnel, with their close district contact, were in an excellent position to suggest revisions. But to take advantage of all possible ideas, it was decided to hold conferences with district construction engineers to get their suggestions. These men, being in constant contact with projects, were considered in the best position to judge which portions of the 1954 specifications most needed change. This idea proved fruitful; many of the changes adopted stemmed from these conferences.

A permanent working committe was appointed to consider revisions of the Standard Specifications and Standard Special Provisions, with each interested department of the division represented.

This committee decided early in their meetings to seriously consider eliminating method specifications wherever possible, and in lieu substitute and result specifications. Obviously, in complicated highway construction work, it is seldom that the final end results alone can be specified, but the committee succeeded in inserting in many of the intermediate steps, end result specifications for that particular step.

Indefinite words and phrases were weeded out, such as "reasonable", "practicable", "uniform", "true to grade and cross-section", "thoroughly", "approved device", "proper quantity", "contains no irregularities", "as much as possible", "or as directed by the engineer", "suitable", and "satisfactory to the engineer." In their place, finite value tolerance specifications were substituted when applicable. However, in some instances it was still necessary to specify construction methods to obtain the desired results, because no rapid method of testing the completed product was known or could be devised at this time.

The committee felt that an end result specification would be satisfactory only if a test could be made within a short time interval to determine whether or not the product conformed to specifications. Only in this way could it be assured that any production or placement of materials which did not meet specifications would be discovered early, and that only a small amount would be involved. The division of highways continually inspects the work of its contractors as the job progresses. Every effort is made to assure that there is a very minimum of waste of effort and materials. If a product used is found to be outside of specifications and unacceptable, the contractor is so informed immediately.

Where any portion of the general provisions applying to all items of work was repeated in certain subsequent sections of the specifications

relating to rejection of unacceptable work—or repeated in suspending work due to failure to perform any contract provision—the repetition was eliminated in the revision. The committee believed that such repetition only weakened the contract, by raising the question as to whether the general provisions would be enforced when they apply to the other following sections where specific reference is not made.

Any specification containing a proven unrealistic tolerance was modified or eliminated. However, for the most part, the 1954 edition contained specifications which have stood the test of time. Therefore, changes were made only where definite need for change had been demonstrated, or obvious progress in methods and equipment dictated change.

New Reference Number System. Major changes were made in many specification sections. Minor revisions were made in section arrangement, and several entirely new sections added. One feature is a decimal reference numbering system for the eight general groups of specifications, which can be retained to fit future editions.

To clarify the most important terms used throughout, and those not adequately defined within the section involved, 19 additional terms have been added to the previous list of 29 (Section 1, "Definitions and Terms").

As the work progressed and certain sections were completed and approved by the committee, those sections involving substantial changes, and which affected operations of contractors, plant operators, aggregate producers and manufacturers, were sent to their respective associations. Comments received and conferences held with representative groups led to some important changes in the proposed specifications.

As space does not permit more, the following is a brief discussion of what are probably the 17 most interesting major changes from the 1954 edition.

1. Changes in the Work. A new method of adjusting compensation for items which vary more than 25 percent from the engineer's estimate has been added. The bid price holds for all quantities between 75% and 125%, but does not hold outside of this range. Thus, either the state or the contractor is "rescued" from bids that are too high or too low when work is increased or decreased more than 25%.

It is anticipated that there will be many more adjustments, resulting in savings to the state, under the new method, than in the past.

2. Alternative Equipment. A new specification of special interest provides for alternative equipment of a size or type different from that which might be specified for work, if the contractor furnishes evidence to the engineer that such alternative equipment will produce work of a quality equal to that obtained by the specified equipment.

The division hopes that this new provision will further encourage the use of promising new equipment which might result in better work at no increase in cost, or equivalent work more economically performed.

3. Prosecution and Progress. On all major projects it is now required that the contractor furnish a practicable progress schedule on a form furnished by the department, showing the order in which the contractor proposes to carry out the work; the dates on which he will start the several salient work features; and the contemplated dates for completing these features.

Proper planning, particularly on complicated projects, is essential to completing the work within the allotted time. Progress in some instances may serve the additional purpose of pointing out to the contractor himself the necessity for doing work in certain sequence which might otherwise have been overlooked.

4. Measurement and Payment. Work paid for on a force-account basis has been revised so that the added percentages for labor, materials and equipment rental are reduced from 25% for each to 20%, 15%, and 15% respectively. The original intent of the 25% markup was to cover the disproportionate large expenses incurred in the handling of the small nuisance items paid for on a force-account basis.

5. Surplus Excavation Disposal. One of the problems relating to surplus materials was that frequently the contractor desired to dispose of the indicated surplus as his first order of work. There have been cases where this was done, and the roadway excavation on the project proved to be insufficient to complete the remaining embankments, so it was necessary to haul back some of the disposed material.

The old specifications were not clear as to whether the contractor had the right to dispose of indicated surplus before completing excavations. The new specifications clearly state that no surplus material may be disposed of before completing the excavation, unless ordered in writing by the engineer. Where there is surplus material, the contractor must satisfy himself that sufficient material is available for completion of embankments before disposing of any indicated surplus.

Should a shortage develop by reason of premature disposal of the estimated surplus by the contractor, he must replace such material and no compensation will be allowed for such replacement.

6. Structure Excavation. An interesting new provision is that no separate measurement and payment will be made for structure excavation and backfill for minor structures (drop inlets, catch basins, culvert headwalls and end walls, and other similar small structures. See No. 15).

7. Ditch Excavation. The 1954 specifications contain a section titled "Ditch and Channel Excavation." This is now simply "Ditch Excavation" and provision is that excavation of any ditch with a bottom width of 12 ft. or more would be paid for as roadway excavation; less than 12 ft., as ditch excavation. The reason: modern earthmoving equipment is ordinarily used in excavating ditches with a bottom width of 12 ft. or more.

8. Free Haul. The free haul limit of 500 feet used for many years

has been increased to 1,000 feet. This change will materially decrease the amount of overhaul calculation necessary on some projects. Reduced engineering costs should result.

9. Aggregate Bases. The new aggregate base section includes a new base called "Class 1 Aggregate Base." This is a new high-type 90 percent-crushed aggregate base, which must be spread with a self-propelled spreader to the required width and thickness in one operation. Motor graders spreading the base from windrows and bottom dump trucks will no longer be permitted. Measurements of existing recently-constructed bases indicate frequent instances where thickness variation has resulted in unacceptably thin sections. Bases must now be deposited and spread within a 5% tolerance of a predetermined rate. This should assure that at no place will the minimum thickness be less than design tolerance.

11. Asphalt Concrete. Specifications covering automatic batching of Type A asphalt concrete are included in the new Standard Specifications, but will be used on only those projects where the special provisions specify automatic batching.

Serious consideration was given to requiring automatic batching for all Type A asphalt concrete, to assure a more uniform product than we now get with manual batching. But commercial plants are not now so equipped, and it was decided that only specific large projects should require automatic batching for Type A. In this way a more gradual change-over may be accomplished.

It is to be noted that automatic batching has been required for the proportioning of concrete aggregates for many years and has proven satisfactory. Although initially, there was a slight increase in cost, we believe the present additional cost to be very small and easily justified by the greater batching accuracy and the elimination of most of the possibility of a manual operator varying the proportions at will to fit the aggregate supply.

12. Portland Cement Concrete Pavement Perhaps the most significant change in this section relates to cement. Cement will now be paid for as a separate item, and the amount to be used on each project will be determined in advance of construction from laboratory tests upon aggregates proposed for use on the specific project. The purpose of this change is to endeavor to produce equal-service concrete pavements throughout the the state by varying the cement content in accordance with the requirements for the particular aggregate to be used. Thus the cement content can now be changed up to 25 percent (see No. 1) by an order of the engineer without an adjustment in compensation.

Concrete pavement will be paid for by the square yard in addition to the cement item, in lieu of the present cubic yard basis.

13. Monolithic construction of 24-ft. width pavement is now permitted. Several projects already have been so constructed by change order and have proven satisfactory and economical.

The most recent of these major projects created state-wide interest by using slipforms. Cost reduction using slipforms is significant since labor forces may be reduced up to 50 percent. Further economies might result from the use of other methods of producing mixed concrete at a faster rate than results from present California methods. The slipform paver used on this particular project was theoretically capable of handling up to 5,000 cu. yd. per 10-hour day, but was only called upon to handle a maximum of about 2,600 cu. yd., or all that the two 1.5 cu. yd. dual-drum mixers produced.

14. Under the new specifications it is no longer necessary to finish concrete pavement exclusively with the Johnson Float. Other methods may be used, provided that they meet the "profile index" and straight edge requirements which apply to all types of finishing. A profile index of 7 in. per mile or less in any one-tenth section is required (as determined by the state's "profilograph" machine).

10. Cement Treated Bases

A thickness tolerance has also been added, which requires that the bases be placed to within 0.05-foot of the planned thickness.

A new test method termed "Titration Test" is used to determine the cement content of the finished product before it is compacted. An allowance of 0.6% deviation from cement content designated by the engineer is the maximum permitted. This allowance is 0.4% for plant-mixed cement treated bases.

After the development of the titration test, which can be made in about 20 minutes, investigation of cement treated bases under construction revealed what we long suspected; that the cement content in both road-mixed and plant-mixed bases varied widely. Variations up to 100% were not uncommon.

The 1954 specifications contained no numerical tolerance requirement; cement was spread or plant-mixed "in such a manner as to insure that the correct and uniform proportions would be mixed with the mineral aggregate."

With these specifications, and without a test method to directly determine the cement content in a sample, a very lenient interpretation was common and inefficient methods of proportioning ingredients accepted by our engineers.

15. Concrete Structures. New provisions for an item of "Class A Concrete (Minor Structures)" has been added to cover pipe headwalls, drop inlets, catch basins, and other small structures. The contract price paid for Class A concrete (minor structures) includes full compensation for all concrete, reinforcing steel, and structure excavation and backfill involved. Formerly each of these items was a separate pay quantity, the determination of which, particularly for structure excavation and backfill, often involved engineering costs approaching the actual cost of the item itself. We believe that considerable saving in engineering costs, without materially increasing the structure costs, will result.

16. Concrete Curbs and Sidewalks. A new specification has been added to permit the construction of curbs by extrusion methods at the contractor's option. Although early such construction, permitted by the special provisions on some projects, was not always satisfactory, analysis show that it was not the fault of the extrusion method. Inadequate inspection and concrete poured too dry to accomplish complete cement hydration were the main faults. Since this method gives promise of satisfactory work at reduced cost, provisions are included to encourage its use.

17. Portland Cement Concrete. Serious consideration was given to requiring that all coarse concrete aggregates be finished-screened at batching plants, in lieu of permitting batching directly from stockpiles of aggregates of specified grading. This procedure would require the screening of concrete aggregates in a manner similar to that now required on asphalt concrete plants.

One of the problems frequently encountered under the present batch plant setup is the degrading and segregation of stockpiled materials. Non-uniform concrete results, which affects pavement strength and riding quality. In a few cases, the formerly within-specification-aggregate itself partially breaks down from handling and will no longer

Continued on page 87

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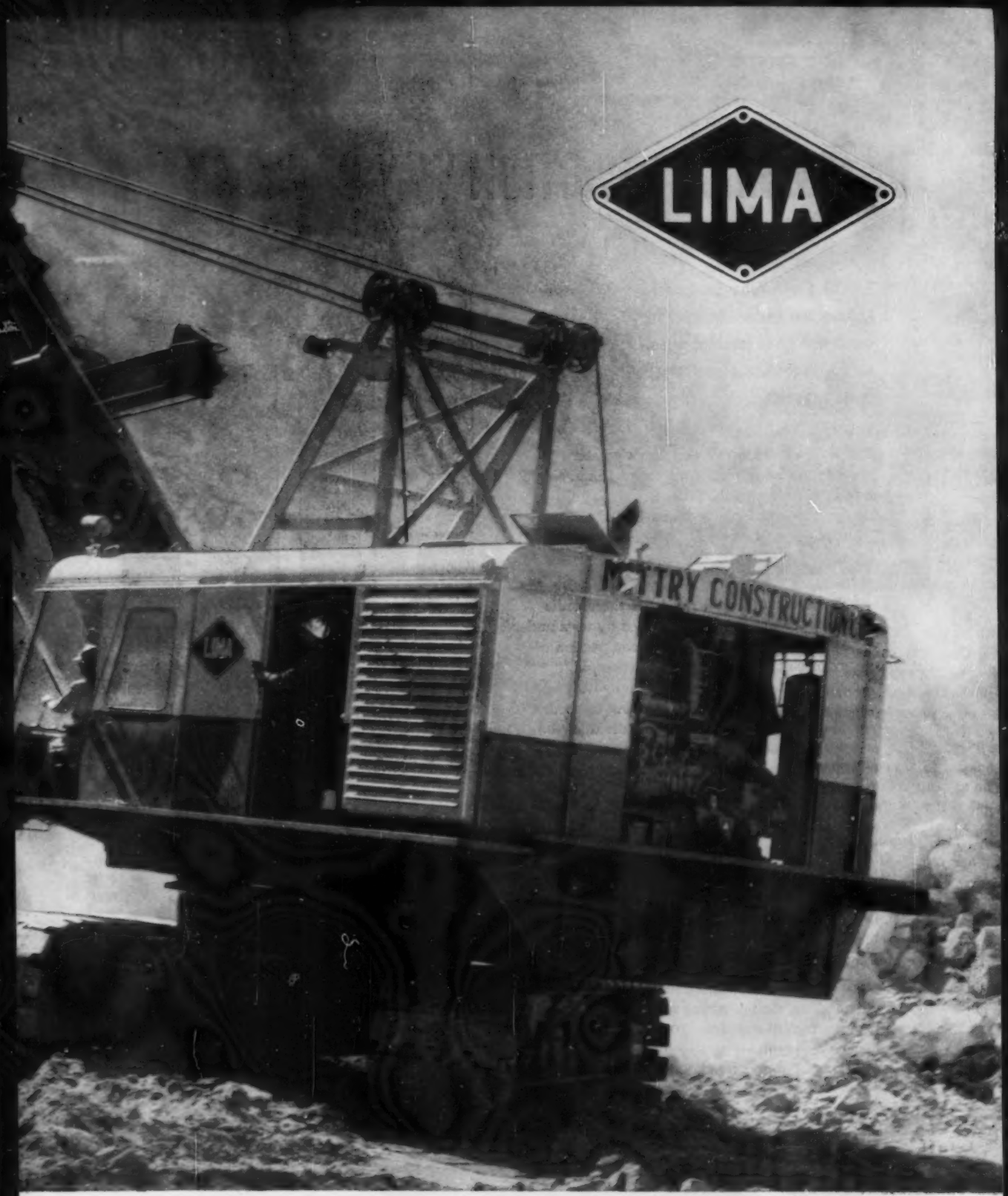

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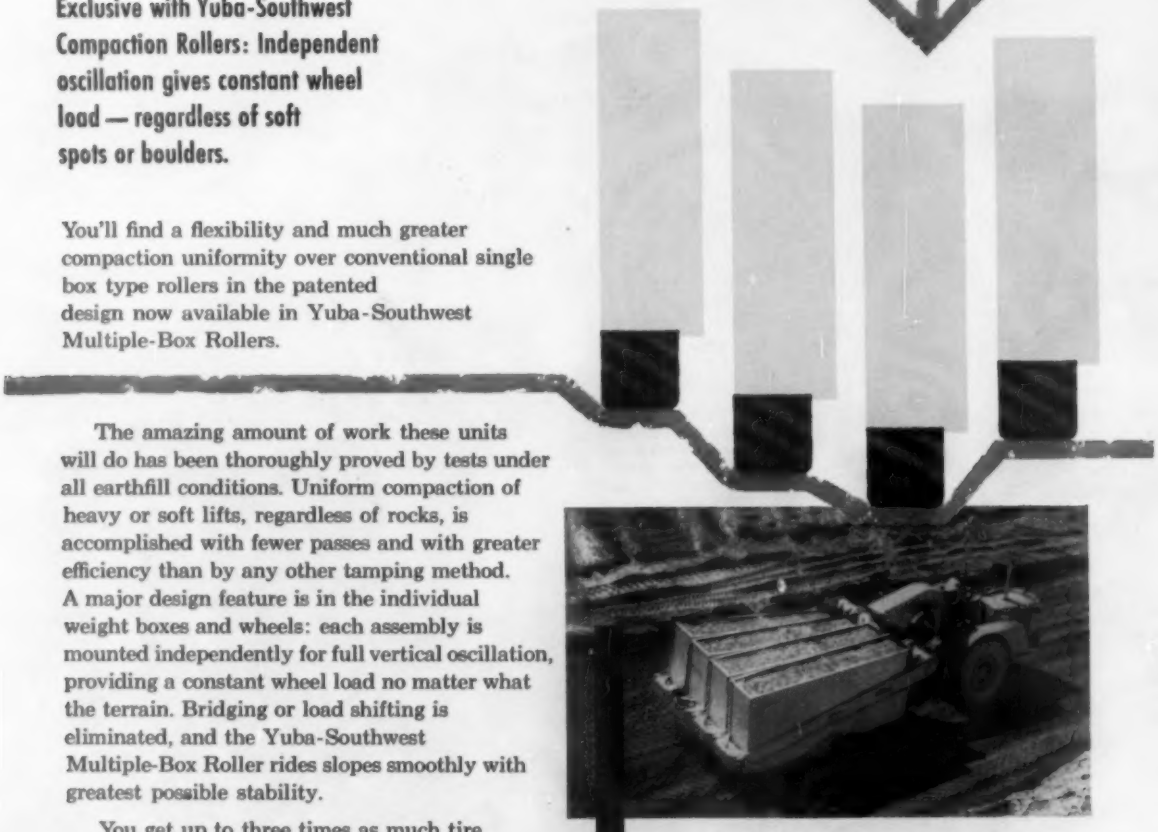
You'll find a flexibility and much greater compaction uniformity over conventional single box type rollers in the patented design now available in Yuba-Southwest Multiple-Box Rollers.



The amazing amount of work these units will do has been thoroughly proved by tests under all earthfill conditions. Uniform compaction of heavy or soft lifts, regardless of rocks, is accomplished with fewer passes and with greater efficiency than by any other tamping method. A major design feature is in the individual weight boxes and wheels: each assembly is mounted independently for full vertical oscillation, providing a constant wheel load no matter what the terrain. Bridging or load shifting is eliminated, and the Yuba-Southwest Multiple-Box Roller rides slopes smoothly with greatest possible stability.

You get up to three times as much tire life, too, over single box type rollers with their limited oscillation. Costly overwear and frequent blowouts are a thing of the past.

Why not get full information on this outstanding, money-saving equipment today. Choose from five models: 10 to 100 tons rated capacity. Adaptable to any job. Assembled in any combination of 3 to 6 boxes with flanged yoke.

Yuba-Southwest also manufactures
SEMI-TRAILER SPRINKLER TANKS
SELF-PROPELLED ROLLERS
SHEEPSFOOT ROLLERS

Sold and Serviced by Your Caterpillar Dealer

YUBA

specialists in compaction equipment

SOUTHWEST WELDING & MANUFACTURING DIVISION
3201 W. Mission Road, Alhambra, California
YUBA CONSOLIDATED INDUSTRIES, INC.

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Despite bigger and more complicated jobs, California highway contractors have met increasingly short, tight schedules, aided by an alert but sympathetic Progress Control procedure in the Division of Highways.

CALIFORNIA'S SPECS

Continued from page 83

meet the "cleanness value" requirement. Finish screening provides an economical opportunity to wash and correct this at the batch plant.

In many locations commercial plants produce and batch concrete aggregates satisfactorily for the contractor. Because of limited working area, with space necessary for remodeling plants, it is impractical to require finish screening. Therefore, although the specifications for finish screening are included in the new book, such specifications will be inserted in the special provisions for only certain large projects.

Conclusion. The new 1960 edition of the California Standard Specifications, we believe, will result in improved quality work at little or no additional cost. However, time alone will prove whether or not this is the case. Progress cannot be realized without change. In fact, we probably retrogress if we make no changes. Therefore, the Specification Committee is already at work on several proposed Standard Special Provisions which may soon supersede portions of our newly completed specifications.

"Back to Oxen," Wet Autumn Solution

Michigan contractors in 1959 experienced the worst Fall road construction season in recent history, notes a bulletin from the state highway.

Conditions got so bad, in fact, that at least one enterprising road contractor rented a team of surefooted oxen and a board scraper to work on a project. Contractor C. E. Utterback of Mt. Pleasant, Michigan, made a deal with a farmer for the animals, which were worked to clean out drainage ditches alongside a 6-mile reconstruction job on M-46 in Newaygo county.

Contractor production over the state was surprisingly high despite the weather, noted highway commissioner John C. Mackie, with rains double normal, the contractors, however, averaged less than 10 full working days during October.

In Michigan, this was one road contractor's answer to ditching work despite a cold, wet October.

AED's Convention Committee met in Chicago recently to put the finishing touches on the planning for the Association's forthcoming Meeting. From the left, Elaine Macey of AED's Convention Department; Beal Shaw, Shaw Sales & Service Co., Los Angeles, Calif.; B. A. Sellers, Salina Tractor Co., Inc., Salina, Kans.; W. G. Bowman, AED Convention Manager; AED President F. J. Fitzpatrick, Parker-Danner Co., Hyde Park, Mass.; Convention Committee Chairman L. P. Deephouse, Deephouse Equipment Co., Inc., Berlin, Conn.; R. J. Panke, Flesch-Miller Tractor Co., Indianapolis, Ind.; W. A. Patterson, Richards Equipment Co., Waco, Texas, and John G. Lindner, Jr., Bark River Culvert & Equipment Co., Eau Claire, Wis.

AED Clan Gathering Again in Chicago

Chicago soon will once more play host to construction equipment distributors and manufacturers, as they assemble for the 41st Annual Convention of the Associated Equipment Distributors. The convention, held January 24-28, at Conrad Hilton Hotel will spotlight the industry's management problems as it enters the sure-to-be-eventful "Sixties."

With more than 3500 delegates registered far in advance, a record number of companies are expected to attend.

L. P. Deephouse, Deephouse Equipment Co., Inc., Berlin, Conn., chairman of AED's Convention Committee, states that the four-day business program will focus attention on present and future management goals in such areas as personnel selection, sales management, service to customers, and distributor-manufacturer relationships.

The Convention agenda will present an imposing array of speakers. The opening session on Monday will be presided over by AED President F. J. Fitzpatrick, Parker-Danner Co., Hyde Park, Mass., who will deliver the keynote address.

Discussing distributor-management will be three well-qualified men: C. W. Wright, prominent business consultant from Willowdale, Ontario, Canada, will speak on communications in management; Dr. W. J. E. Crissy, Personnel Development Association, New York, N.Y., will talk on motivation of salesmen; and Arthur Oriel, Science Research Associates, Chicago, Ill., will stress the importance and effectiveness of proper personnel selection procedures.

Distributor-manufacturer relations will also be a key topic at the Convention. Dr. Laurence J. Taylor, Hillsdale College, Hillsdale, Mich., will lead off a presentation by AED's Industry Round Table, a committee of 10 distributors and 20 manufacturers. This formidable group will put up a panel to answer the ten most important questions confronting the industry today. Heading the panelists will be Harold M. Doolen, Western Construction Equipment Co., Billings, Montana, and Jack W. Hardesty, Baldwin-Lima-Hamilton Corp., Lima, Ohio, the Round Table co-chairman.

With the current and future status of the Federal Highway Program a major point of interest to AED members, added highlights of the convention will be addresses by General L. W. Prentiss (USA, Ret.), executive vice-president, American Road Builders Association, plus a top official of the Associated General Contractors of America.

Also in the spotlight will be the curriculum in construction equipment distribution now being offered at Clarkson College of Tech-

Continued on page 95

ALLIS-CHALMERS TS 360

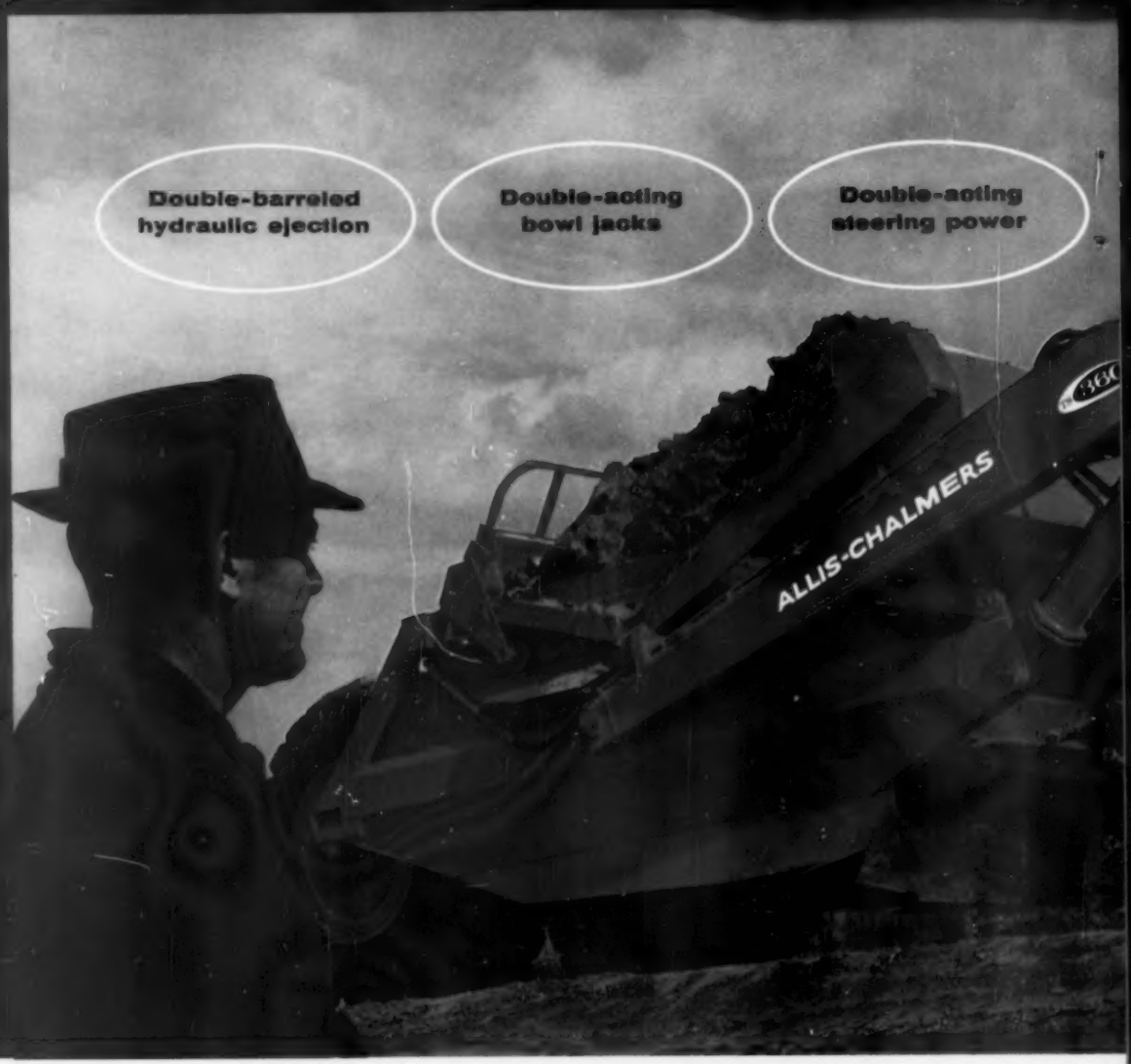
Everything you'd want in a big scraper... if you were building it for your own big jobs.

New 30-yard capacity . . . backed by 340 turbocharged horsepower . . . gives you big-volume production that will match or surpass anything you've seen in over-all performance.

You've got the size . . . the power . . . the durability to tackle any size job . . . from I-System dirt to the biggest dams . . . from king-size housing developments to big state highway jobs.

From radiator grille to push block, the new *360* gives you more dirt-moving features than any other big scraper: high-torque engine characteristics and snappy acceleration . . . full 90-degree steering . . . new steering and scraper control that mean new standards of big scraper performance.

Look at it from your viewpoint . . .



NEW STANDARDS OF

Plus the exclusive advantages of KON-TORK differential... a combination

The new TS-360 offers all-hydraulic performance... constant, double-acting hydraulic power and an independent steering system.

The TS-360 brings you KON-TORK differential—torque-proportioned traction that really provides all-weather performance . . . plus the time-saving advantages of smooth, controlled spreading.

So whether you're speeding away from the pusher or duck-walking through a soft fill, you'll find that the new TS-360 performs more dependably, day after day, than any other big motor scraper.

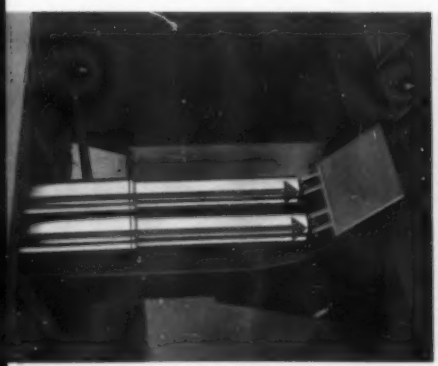
Positive penetration at cutting edge
This demonstrates the TS-360's tremendous penetrating force. See how the *360* puts enough pressure on the cutting edge to pivot the scraper *and its load* clear of the ground.

ALLIS-CHALMERS TS 360

ALLIS-CHALMERS, CONSTRUCTION MACHINERY DIVISION, MILWAUKEE 1, WISCONSIN

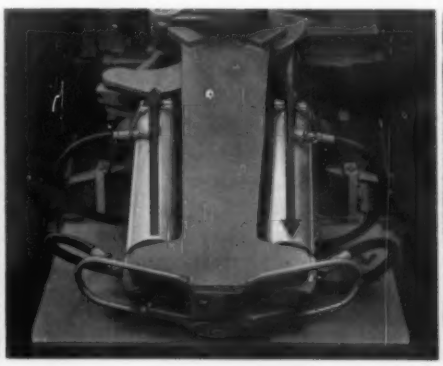
ALL-HYDRAULIC PERFORMANCE!

that means extra profit capacity for you...loading, hauling and spreading.



Double-barreled dump power

Twin telescoping cylinders provide powerful forced ejection in three progressively faster stages. Even chunky material is ejected quickly, cleanly without "pumping" tailgate.



Push/pull steering power

Double-acting steering jacks fed by an independent hydraulic system assure steering power to match any situation... more power in full 90° position than other units offer straight on.

Steady torque, positive traction

KON-TORK differential automatically controls the distribution of torque to the drive wheels. The result... maximum traction to match any working condition.

KON-TORK is an Allis-Chalmers trademark.

EVERYTHING YOU'D WANT IN A BIG MOTOR SCRAPER

Turbo-charged 340 hp Allis-Chalmers Diesel Engine

30 cu. yds. heaped, 22.3 cu. yds. struck

Speeds to 26.3 mph... 5-speed transmission

Empty weight—63,150 lb.

- KON-TORK differential
- Two-way hydraulic steering
- Full 90° steering . . . 180° turn in 35 ft. 8 in.
- Double-acting hydraulic bowl jacks
- Double-barreled hydraulic ejection
- 10 ft. apron opening . . . highest in the business
- Outstanding flotation . . . giant size tires . . . and equal weight distribution on all four wheels when loaded

Get the full story on the all-new, all-hydraulic TS-360 from your Allis-Chalmers dealer now!

move ahead with

ALLIS-CHALMERS

...power for a growing world

Columbia Calcium Chloride–rock salt mixtures keep roads open . . . costs and accidents down

Will you be getting a call from this disgusted driver? Keep complaints down, roads open and safe this winter with economical Columbia Calcium Chloride–rock salt mixtures.

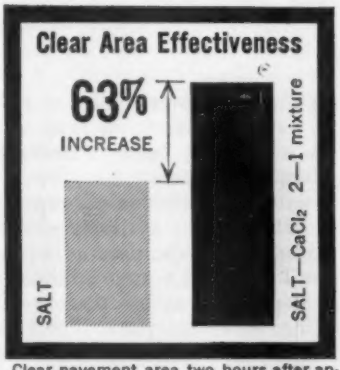
BARE PAVEMENT FASTER: Test results (right) clearly prove the ice-melting effectiveness of Columbia Calcium Chloride–rock salt mixtures.

ALL-TEMPERATURE EFFECTIVENESS: Columbia Calcium Chloride–rock salt mixtures assure quick melt at *all* temperatures—from freezing to sub-zero.

SAVE TIME, MONEY: Columbia Calcium Chloride and rock salt mix easily, can be stored indefinitely, ready for instant use. Bulk purchase and storage help stretch maintenance budgets.

You can't compromise with ice and snow. Keep your roads safe this winter with Columbia Calcium Chloride–rock salt mixtures. For more information write to our nearest District Sales Office or to our Pittsburgh address.

You'll like doing business with Columbia-Southern.



Clear pavement area two hours after application of calcium chloride–rock salt mixtures is 63% greater than salt alone in 25-30° temperature range.

(Based on field studies in Michigan sponsored by the Calcium Chloride Institute)

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Streamlined placement and compaction of granular subbase material, as seen on the recent Ohio Interstate project.

Efficient Subbase Routine Meets Ohio's Exacting Specs

The front-cover photo, and the similar one shown here, were taken recently near Painesville, Ohio, on the Interstate project of Horvitz Construction Company, Cleveland. The granular subbase placement and compaction in progress focuses on a step in concrete road paving that has been greatly refined in recent years. The Ohio practice typifies this careful attention to detail.

In Ohio as in other states the inspectors are trained to work with the contractor to meet all three major objectives: proper compaction, uniformity, and good gradation control. The contractor's problem of course is to reduce the spreading and compaction to an efficient routine, keeping just ahead of form setting. Mechanical procedures particularly are judged for their ability to secure uniformity, and do so with low equipment and labor cost.

On the Horvitz project extending 7.8 dual miles, this firm worked ahead of a central-mix, truck-delivery setup with a Galion motor grader shaping the template grade, and a Jersey spreader with crawler tractor for placing granular lift material mechanically for the 24-ft. wide paving train. Then followed a compaction team consisting of a Jackson Model MC130A vibrator and a 12-ton 3-wheel steel roller. This contractor found that one or two passes with the vibrator plus ironing out with the steel roller "did it," and the small vibrator with 8'8" wide pass, as against one with a wider working width, was preferred.

A word about the Model MC-130A vibratory machine shown. Dating from 1955, this rugged veteran has handled a lot of project work, with various shoe widths to fit job needs. For the work shown the outside two of the six 26-in. vibratory pans were removed in order to handle an 8'8" width instead of the full 13 ft., the full base spread being made in three strips.

The contractor on Ohio state

road work can perform compaction with any type of equipment he elects, and by any method except that he is required to do additional rolling after the forms are set and the subgrader has made its pass. Ohio contractors have tried rubber-tired rollers, vibrating shoe compactors, and steel rollers, the latter being on hand for finish rolling and ironing out.

As shown in the cross-section, the Ohio specification I-22 base material here discussed was spread to a varying thickness, usually 6 in. minimum under the pavement. Where the lift is only 6 in., it was placed in one lift, but if totaling greater thickness, two lifts were required for spreading and compaction.

The Ohio specifications for "I-22" state-designated material are aimed at getting a free draining, frost resistant base that will also resist pumping action under pavement joints. The minus 200 fraction is limited to 15 percent. Bank-run glacial gravels used in the area of the Horvitz project usually meet requirements and produce a good base.

Ohio state procedures designate two methods of field control of granular base lifts, both dependent on field density tests. Under a memorandum to division office personnel from state construction engineer Edison W. Ellis, issued early in 1959, the importance of good workmanship and the test procedures were spelled out in some detail. Under method "A" laboratory dry density of material in place is compared with maximum density as compacted in a moisture-density mold. Procedure "B" compares wet density in place with maximum wet density as compacted in the moisture-density mold in the laboratory.

Procedure "A" (requiring drying) is considered desirable for the first day or two on a project, to establish moisture information and density patterns. Method "B", requiring less testing time, is then used for routine compliance tests thereafter.

The memorandum suggested that inspection and laboratory personnel time saved by the quicker "B" test be utilized "to make additional tests in additional locations, and to inspect for compliance with construction requirements such as uniform roller coverage, uniform and proper moisture content for compaction, surface smoothness, etc."

Typical cross-section of pavement and base on the Ohio "Route 1" Interstate project. 1-22 material is that here discussed. 1-18 is a granular select shoulder material.

Moisture content at time of compaction must be at or near optimum, with additional sprinkling indicated if found more than two percentage points under optimum. Drying before rolling is required "if moisture is more than optimum and the material deflects or displaces under the compacting equipment and does not compact properly."

An important part of this memorandum to the field engineering force, is the requirement that before the base material is placed a test section must be built for each type of material to be used. This section must be long enough to permit normal use of the contractor's particular equipment. Compaction must continue over a portion of the test section until there is no further increase in density. Then, for comparison, using the same equipment, compaction of further material is required in accordance with the above "A" and "B" methods.

AED CONVENTION

(Continued from page 88)

nology, Potsdam, N.Y. Gene Capehart, Boehck Engineering Co., Inc., Houston, Tex., chairman of AED's Education Committee, will report on the present status of the college's program plus plans for similar programs in other colleges.

Of prime importance on the convention program is the election of AED national officers for 1960. The Nominating Committee will present this slate: for president, Jewel A. Benson, Benson Tractor Co., Houston, Tex.; executive vice-president, Herbert J. Mayer, Western Machinery Co., San Francisco, Calif.; vice-presidents, Richard F. Newlin, Newlin Machinery Corp., Kansas City, Mo.; Braxton Blalock, Jr., Blalock Machinery & Equip. Co., Inc., Atlanta, Ga.; and R. Boyd Somerville, Ontario Equip. & Supply Ltd., Toronto; treasurer, W. R. Parnell, Construction Machinery Corp., Shreveport, La.

A Welcoming Luncheon program will feature Harry A. Stuhldreher, director of public relations, U.S. Steel Corp., as guest speaker. He will talk to the machinery men on the ramifications of the recent steel strike situation.

Throughout the convention, informal talks between distributors and manufacturers play an important role. Manufacturer headquarter suites throughout the Hilton Hotel and the popular Conference, Display and Exhibit Center—CONDEX—in the hotel's exhibit halls—will be busy centers of activity throughout the Convention. More than 350 manufacturers of construction equipment and accessories will be represented.

Of special interest to Canadian dealers will be the Canadian Associated Equipment Distributors semi-annual meeting on Tuesday, Jan. 26, always held in conjunction with the AED Convention.

The industry will take time out to honor retiring AED President Fitzpatrick at two affairs—the traditional Early Birds' Breakfast on Monday, and the association's 41st Annual Birthday Party, Tuesday.

Working with Chairman Deephouse are the following members of the Convention Committee: John J. Lindner, Jr., Bark River Culvert & Equip. Co., Eau Claire, Wis.; R. J. Panke, Flesch-Miller Tractor Co., Indianapolis, Ind.; W. A. Patterson, Richards Equip. Co., Waco, Tex.; B. A. Sellers, Salina Tractor Co., Inc., Salina, Kansas; and Beal Shaw, Shaw Sales & Service Co., Los Angeles, Calif.

END RESULTS

Continued from page 64

Again quoting from E. C. Simpson's WASHO paper in reference to the Dens-O-Meter, "Rapid operation and accuracy are the principal advantages. A typical field test to determine the in-place dry density of a soil requires one-half hour or less, which is sufficient for actual on-the-job control of compaction."

Colorado Construction Practices. The Colorado state highway practices are typically reflected on two recent projects: 1) A. S. Horner Construction Co. on an Interstate job 15 miles east of Denver; 2) The Brannan Sand & Gravel Co., for the widening of Colorado Blvd. in Denver.

Horner subcontracted 2,200,000 cu. yd. of excavation to Stevenson Logging Co., of Denver, which firm used scrapers and pre-wetted some 75 percent of the embankment material. The remainder was done with sprinkler trucks. Pre-wetting was done with pipe and irrigation sprinklers. The pre-wetted cuts on this project were allowed to cure at least two weeks before being excavated. Fills were further wetted by tank truck as found necessary. The contractor experienced no particular difficulty in the pre-wetting.

F. P. McNamara, resident engineer, reports that he personally prefers pre-wetting and found it to make project control easier and insured more uniform results.

Density tests were taken on the average of one per 2,000 cu. yd. Two percent plus or minus of these tests indicated poor compaction. Where poor compaction was indicated, the contractor was required to rip up the fill, add water to secure optimum moisture and recompact.

(1) A. S. Horner stated that he had been favorably impressed by his limited experience with end-result specifications. He felt them much better insofar as they affected the contractor's purchase of equipment.

(2) Brannan Sand & Gravel Company placed 50,000 cu. yd. of embankment in the widening of Colorado Boulevard. The soil was mostly scraper-hauled and wetted with tank trucks. Sixty percent of the compaction was by vibratory rollers; the balance by sheepsfoot.

Bill Thomas, Brannan's superintendent, was strongly in favor of end-result specifications. He would like to see their usage extended to all possible areas, including control of traffic during construction. He said, "A contractor cannot afford to cut corners when he has to guarantee the quality of his work." Thomas stated that his construction procedures had changed mainly in the selection of equipment for any particular job.

Jasper Croonenberghs, the job's resident engineer, felt that most of the Colorado contractors' early skepticism over end-results had been completely overcome. He has found end-results to be entirely practical, a time saver to the engineer and occasioning no undue testing difficulties.

Wyoming Construction Practices. While several Wyoming projects were visited, references will be confined to the grading awarded to the Tioga Construction Company on Interstate Route 80, 40 miles east of Rock Springs. Further information on construction practices in Wyoming was obtained in discussion with various state officials.

Tioga with freedom to plan its procedure pre-wetted cuts only to a limited extent. Optimum moisture was usually secured by wetting the fills with sprinkler trucks. Whatever water was left in the water tank was then used to sprinkle the cut area.

Tioga used a Buffalo Kompactor, a Southwest 75-ton pneumatic roller pulled by an International DH21, and a BMCO 50-ton pneumatic roller pulled by a heavy tractor. Ray Arnde, grade foreman, felt that end-result specifications were much better for all concerned. He cited previous experiences with Wyoming end-result specifications, wherein he had gotten good compaction by vibratory equipment, often with one pass.

In a three-way discussion with O. F. Baldwin, Wyoming's assistant construction engineer, J. J. Evans, district engineer, and A. V. DeBernardi, resident engineer, the following opinions were expressed: the consensus is that water costs had gone up somewhat, a natural result of the contractor's endeavor to secure the desired end-result with the least compacting effort. End-result specifications, as demonstrated in Wyoming, was a "good thing for the engineers, reducing much paper work and supervisory activity."

Evans: previously it was time-consuming for project engineers to have to order the contractor to put a certain type of roller at a certain place at a certain time. Some contractors followed the instructions readily; others took a great deal of nagging.

DeBernardi: has used the carbide moisture tester and found it to be highly satisfactory. Again, Evans: End-results have placed the responsibility for ramrodding the job on the contractor's supervisory personnel, eliminating a sore spot in contractor-engineer relations. The contractors have had a better attitude since an inspector no longer looked over their shoulders.

Tioga Construction Company was securing specification compaction with an average of two passes with a 50-ton roller, after having carefully routed hauling equipment over the fills.

Group opinion for this job: End-results has brought about a lowering of bid prices in Wyoming; in some instances prices on compaction are down as much as 1.5¢ per cu. yd.

Idaho Construction Practices. The practices of LeGrand Johnson Construction Co. on its 6.6-mile Interstate project north of Pocatello are taken as indicative of working under Idaho specifications.

Embankment material was prewetted and scraper-hauled. Compaction equipment consisted of two Vibro Plus OH31 vibratory rollers, one Grace 50-ton pneumatic and one Idaho Sprocket sheepsfoot.

Thomas Perry, grade foreman, depended on the two vibratory units for most compaction. He had found these units satisfactory for almost all soils, provided the rate of vibration was properly controlled. He prefers slow speeds for granular material; 1200 to 1600 rpm for other soils. He had completed 4½ miles of work before a test indicated insufficient compaction. Four tests failed in one area due to crowding when rain had raised the mois-

Will this material meet embankment gradation requirements? Under "results" specs, the contractor takes more initiative in the answer.

ture content above optimum.

Perry expressed a strong preference for pre-wetting. Foundations for embankment were pre-wetted about a week in advance of grading operation and compacted by sheepsfoot roller. Cut areas were pre-wetted and allowed to cure for a longer period.

The sheepsfoot was seldom used on embankment, but was found extremely useful in aerating and compacting over-optimum material. The 50-tonner proof-rolled and filled in on special situations. Scrapers were carefully routed to utilize their maximum compactive effect.

Perry, too, expressed a strong liking for end-result specification. He appreciated the opportunity they afforded him to use his own judgment in the choice of equipment and methods. He felt that he could now take full advantage of all of his previous experience to secure results economically. He was high in his praise of the promptness with which he received test results from the test crew.

Opinions and Comments. The following quotations are selected to supplement the discussion.

Of the numerous individuals interviewed, only one adverse comment was received. One large contractor said he felt that end-result specifications gave the engineer too much of a chance to exercise vindictiveness.

Earl W. Devalon, managing director, Colorado Contractors Association, considers the benefits to the contractor to be mostly mental —the personal satisfaction of choosing methods and equipment.

Adolph Zulian, Colorado's engineer of survey and plans pointed out the effective role of end-results in reducing the formerly complex number of bid items. He finds end-results have little effect on design.

George N. Miles, Colorado's district engineer at Denver, feels that (1) end-results are basically good; (2) present concept represents the first step in seeing if there isn't a better way of securing quality; and (3) correct *interpretation* of results lends more to the value of end-results than does the actual wording.

There were no adverse comments regarding the quality of the end product. No contractor supervisory personnel complained of having to unreasonably tear up and recompact embankment. End-result specifications scored almost perfectly in obtaining quality.

Existing tests are adequate for end-result embankment specification, but can, and will be improved. The presently improved test methods cannot be attributed to end-result specifications in any large degree. They appear however to have been a forerunner and hold the key to expanded usage of end-result specifications. Better tests will, as a minimum; reduce engineering costs by freeing personnel for other duties, and aid the contractor in his use and choice of equipment and methods.

End-result specifications cannot be isolated as a thing apart. Their conception and usage must be taken as a product of this age of cooperative effort. They constitute a recognition by engineers that the most economical results will come from providing incentive and opportunity, so that the ingenuity and experience of the whole construction industry can be brought to bear.

To sum it all up—the evidence presented points to an expanded usage of end-result specifications. Growing pains can be expected, but will ultimately largely disappear. This will encourage the development of new and better construction equipment and materials. Since control of quality of the end product is the real goal of all technical specifications, adequate and rapid tests are the crucial factor.

Michigan rubber-tired dozer prevents job shutdown

Haul trucks bogged down until Model 280 arrives to spread fill and compact in one operation

Push-loading a fleet of five 15 yd scrapers, the Model 280 boils 'em over in only 45 seconds.

When a Michigan Model 280 rubber-tired Tractor Dozer was put to work on the Rieth-Riley Construction Co job near South Bend, Indiana, filling and compacting problems—which threatened to close the job—were solved.

It was early spring. This Goshen, Ind, firm was working on a $1,000,000 contract, building part of a new four-lane divided highway to bypass South Bend. Yardage totalled 644,000 cu yds, mostly clayey sand. Trouble started when pockets of wet glacial clay were encountered at the borrow pit. Then it snowed and the material became even more unstable. The dozen 10 yd trucks hauling onto the fill were continually bogging down. A 10-ton, 3-wheel roller couldn't compact fast enough and a pair of 200 hp crawlers couldn't spread fill and pull out trucks too. The job was near a standstill.

At this point, Grade Foreman Truman "Cannonball" Condra thought it might be a "good idea" to try a mobile high-speed Michigan Tractor Dozer. Michigan Distributor, Deeds Equipment Co, brought out a 262 hp Model 280.

Michigan performs dual role

Half a day's work with the Model 280 unsnarled the tangle. The key was speed. The fast rubber-tired rig could assist trucks when they bogged down and still have time to spread material across the length and 250 ft width of the fill.

Compaction: 95% in normal dozing

Later, an even more amazing thing began to happen. As the day wore on, trucks no longer became mired in the unstable material. The Model 280 with its big hydroflated 29.5 x 29 wide-base tires and working weight of 56,000 lbs, was compacting fill so well the trucks could get through. Moreover, in the *normal course* of its dozing job, required compaction was being attained by the Michigan alone . . . compaction which equalled the state specification of 95 to 100% Proctor.

Handles fill work too

So, trucks got through and the job was kept open. The Michigan Model 280 handled the spreading of fill and compaction for 12 trucks—3,000 pay yds per 10 hr day. The two crawlers were put on standby. Track costs, a major problem in the sandy material, were eliminated. The roller was retired.

Spreading scraper-dumped fill 500' takes the Michigan only 45 seconds. Return, in fast reverse, takes 25 seconds.

Production jobs all over the grade

In later weeks, as weather and soil conditions improved, the Michigan's versatility, power and speed paid off even more, both on additional production jobs and odd jobs. On construction of the main interchange, for instance (a fill 47 ft deep with grades up to 2 to 1), the 262 hp Model 280 dozed 5,000 pay yards per 10 hour day, per cross-section measurement. On push-loading assignment—working with five 15 yd scrapers, the Model 280 loaded each to spill-over in only 45 seconds. Spreading scraper-dumped material also took an average of 45 seconds over a distance of 400 ft. With up to 28 mph reverse, back-up "dead head" time here usually amounted to less than 30 seconds.

"Right there" for emergencies

The Michigan's 28 mph speed permitted runs from one end of the two mile job to the other for handling such emergencies as starting stalled equipment, pushing loaded scrapers over hills and pulling out bogged-down trucks. It came in handy when repair work was called for. The high blade lift made it possible to "pull out" engines and power-train components for repair, making it unnecessary to call in an A-frame truck. The Michigan also back-filled drainage structures . . . in less than two hours overtime it could complete 10 or 12, each structure taking only 10 to 15 minutes.

In summary, the Model 280 did production work wherever used . . dozing, shaping, rough grading, compacting, push-loading. It needed no planks when traveling over railroad tracks or concrete and it could quickly run around to handle emergency situations. When the bulk of earthmoving was completed, the Model 280 was kept on to complete the finished grading before paving began.

Grade Foreman Condra put it this way, "I won't say our Michigan will do everything, but I am convinced we can't get along without it." Maybe *you* "shouldn't get along without a Michigan Tractor Dozer" either. Why not call us for an on-the-job demonstration. Choose from any one of four sizes—162, 262, 375, and 600 hp. No obligation.

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New machines, new ideas

5 Michigan Tractor Scrapers and a 600 hp Michigan Tractor Dozer, on Southwest Interstate job, move 8,750 tons daily

Some new equipment and some unusual techniques are helping M. M. Sundt Construction Co., Tucson, Arizona, get an important 20% increase in production.

The new equipment includes *five* 375 hp, 29 yd Michigan Tractor Scrapers and a big *600 hp*, 104,000 lb, Model 480 Michigan Tractor Dozer. The Scrapers are being push-loaded by the Dozer with an average of *35 tons in 35 seconds* . . . this weight is extremely accurate since *each load is being weighed*, according to Arizona state regulations, by a state representative on a truck-type platform scale.

Borrow sprinkled 7 days

The unusual techniques were developed to speed dirtmoving and to more easily meet strict compaction specs. For

On this job, all loads are being scale-weighed. Records show faster, easier-loading Michigans are moving 20% more paydirt per day than similar-sized pans formerly used. Owner Sundt (left) also likes Michigan "design simplicity, ease of operator training," plus "best service I've ever seen, both from factory and dealer." Distributor is Western Machinery Co, Phoenix.

600 hp Michigan Dozer heaps 29 yd Michigan Scraper in 35 seconds.

increase production 20%

example, before digging starts, the dry, sun-baked borrow area is laced with perforated pipe. Water sprinkles out night and day for about a week. Once the soil is saturated seven to nine feet deep, Sundt turns off the water, removes the pipe, brings in his earthmoving machines. Pre-wetting, say men on the job—a 5.3 mile, $1,031,000 section of Tucson-Benson Interstate Highway—makes for easier loading. It also has eliminated the clutter of water wagons and motor graders and extra sheepsfoot rollers which previously kept scrapers waiting in line to unload.

Success with Michigan Tractor Shovels prompts purchase of Scrapers, Dozer

Both the Michigan Scrapers and Michigan Dozer arrived on this job in mid-contract. "It wasn't that we were doing badly with our existing scraper-pusher fleet," explains Don Kellogg, Sundt's equipment supt, "it's just that we thought we could do better. We had excellent experience with Michigan *Tractor Shovels*, and so, because they have the same power train design, expected the same results with Michigan Scrapers and Dozers. We got 'em too. Moving 119,500 yds roadway excavation, 644,100 tons of borrow, 242,400 tons select and 49,000 tons aggregate base, we should finish 30 days ahead of schedule, *without changing our work day!*"

Higher scraper production is one reason, of course. Less downtime is another. "And good visibility," Ferris Ray, project manager, points out, "has reduced waste time. Scraper and Dozer operators can always see each other. No one has to blow horns or ring bells or stand up. Just a few simple hand signals coordinates all work.

Load at 7½ mph

"Scrapers load the 2800 lb/yd silty caliche mixture in second gear (7½ mph). They power-shift instantly to third (15 mph) as they're shoved off . . . move to and from the fill at speeds up to 30 mph . . . positively eject all loads." The result is 50 two-mile cycles *per Scraper* per 8-hour shift . . . 8,750 tons total . . . 20% more paydirt then previously moved by same size fleet of another make.

"The Monster"

The Michigan Model 480 Tractor Dozer is proving a remarkable pusher. The men have dubbed it The Monster. "It sure has power!" says Clay Smith, operator. "It loads these big Scrapers fast (usually in second gear 7½ mph) . . . backs up fast . . . goes from one borrow area to another fast (15 to 28 mph).

"In fact," continues Smith, "there isn't much this Dozer can't do fast. I've trimmed on 2-on-1 slopes and push-loaded on a 2-to-1 slope. I'll admit I wasn't too happy when I was told I had to run the Model 480. I'd been a crawler man for years. But I sure changed my mind! The power-steered, power-shifted 480 is much easier to run—in fact, when I climb down off the machine at the end of a day, I'm still rarin' to go."

Built-in scarifier

Where borrow is tight and tough, an optional Model 480 attachment, blade-mounted scarifier teeth boost production. When dozing or pushing forward, these teeth fold up, out of the way. But on return operator drops blade, teeth jut out and rip 8 inches deep . . . just right for the next scraper pass.

Michigan units like these are helping dirtmovers all over the country boost production. Three Scraper models—10½, 19, 29 yds—four Dozers—162, 262, 375, 600 hp—are now available. Your Michigan Distributor will be glad to show them to you.

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HIGHWAY COMPACTION CONTROL

Continued from page 75

procedures requiring highly trained personnel. Due to the increased speed of producing density results by the new method, closer control over quality can be maintained than with time-consuming conventional test procedures The new method causes less interference to the contractor's operations.

(3) Reduces the personal element that is involved in conventional test procedures, thereby increasing the consistency of density and moisture test results.

(4) Provides a means of performing density tests upon large sized aggregate base courses and on frozen material that is not practical with conventional methods.

(5) Effects a monetary saving because of its greater speed and closer control over quality than the time-consuming conventional test procedure.

Equipment Requirements for Embankments: About 80 percent of the states have specific equipment requirements, in that the type of equipment used to obtain a required density is specified in considerable detail. The remaining states have an "end result" requirement; the contractor may use any type of equipment which will produce the specified density. The following is typical of such end result requirements: "The contractor may use any type of compaction equipment he deems necessary to obtain the specified density."

Steel wheel rollers including tandem rollers of 8- to 10-ton capacity and 3-wheel rollers of 10- to 14-ton capacity are permitted in a majority of the states. Several states require steel wheel rollers where such materials as slag, coarse gravel, rock or layers of soil and rock are encountered.

All but about 20 percent of the state have specific requirements for sheepsfoot and tamping rollers, in that the general type, area of tamping feet and/or "psi" of contact area are specified. The range of minimum contact pressures specified in 31 states varies from 100 to 500 psi. The number of states in each range is shown in the table.

The variance here between low and high is 400 percent. Several states have maximum contact pressure requirements. These vary from 175 to 550 psi without qualifications, a variance of over 200 percent. In actual practice, contact pressures up to 750 psi have been employed on sheepsfoot rollers to break up flat rock and shale.

Practically all states allow pneumatic rollers in embankment compaction, with 7 states permitting their use when approved by the engineer. While minimum and maximum width, number of axles and minimum number of wheels are sometimes specified, there are at least four methods now in use in expressing the compacting ability of pneumatic rollers. These are: (1) Gross weight of vehicle; (2) Wheel or tire load; (3) Weight per inch of tire width; (4) Tire inflation pressure.

Five states rate pneumatic rollers on the basis of gross weight with one state requiring 5 tons, 2 states requiring 8 tons, one state 10 tons and another 30 tons. Gross weight ratings are meaningless unless the number of wheels, tire size and inflation pressure are known.

Seven states specify minimum or ranges of wheel loads as follows:

Min.		1,000 lb.	1 state
Min.		1,400 lb.	1 state
1,000	-	2,000 lb.	2 states
1,000	-	2,500 lb.	1 state
Min.		4,000 lb.	1 state
Min.		6,000 lb.	1 state

Wheel loads do not express compacting ability unless the tire size and inflation pressure are known. Wheel loads within a range of 1,000 to 2,500 lb. even when used with the smallest compactor tire now available, will not produce the compactive effort needed in modern highway construction.

Seventeen states rate the required pneumatic rollers by "weight per inch of tire width" as follows in pounds:

43-300	1 state
100-325	1 state
150-350	1 state
200	4 states
225	3 states
250	2 states
300	2 states
325	2 states
400-600	1 state

The overall variance here between minimum and maximum is 1,300 percent.

While the "weight per inch of tire width" when applied to steel wheel rollers gives a representative measure of compacting ability, the same criterion loses much of its significance when applied to pneumatic tires. With steel wheel rollers, a uniform rectangular contact pattern exists under most conditions. On the other hand, the oval contact pattern produced by a tire changes as wheel loads and inflation pressures are varied.

In general, the tire contact length changes to a greater degree than the tire contact width as the inflation pressure and wheel load are varied. If the weight per inch of tire widths are converted into wheel loads at various inflation pressures, a sizeable range in contact pressure results. For example, a 10.00 x 15 12-ply tire exerts an average contact pressure of 60.4 psi for a wheel load of 5,000 lb. when inflated to 55 psi. If the wheel load is kept at 5,000 lb. and the inflation increased to 100 psi, the average contact or ground pressure increases to 87.2 psi.

Several states specify the tire inflation pressure. This is of limited significance without tire size and wheel load. Contrary to popular belief, inflation pressure and contact pressure are not necessarily synonymous.

Last year in developing special provisions for test rolling with a heavy pneumatic compactor, the Michigan state highway department recognized the need for better criteria in rating the compacting ability of pneumatic rollers. Quoting from the

Highlights on Compaction Status

Density Percentage: One-third of states say 95% of "AASHO standard", four say 90%, 18 sliding scale (some upward, some downward, based on soil classification).

Test Methods: In state of change in some states, to speed field approval. Nuclean methods in limelight.

Equipment Requirements: Most states specify some rolling equipment details. Tamping roller details vary widely: 100 to 500 psi foot pressure for example. Rubber-tired roller requirements reflect lack of basic data and also vary widely.

The authors review equipment developments, point to need for more performance data of a controlled or test nature, and suggest that greater use of "results" specifications represents a goal for all to work toward.

Mr. Radzikowski's article is from a paper "Compaction of Highway Embankments and Surfaces," prepared with John J. Laing, Chief of BPR's Development Division, Road Equipment Branch, and presented before the Society of Automotive Engineers' National Farm, Construction and Industrial Machinery Meeting, Milwaukee, Wisconsin, September 15, 1959. This abridgement is confined because of space limitations to embankment compaction. Readers desiring the complete paper which also discusses base and pavement layers, can secure a copy by writing the Society of Automotive Engineers, Inc., 485 Lexington Avenue, New York 17, N.Y., or to the author, Washington 25, D.C.

special provision:

"The contractor shall furnish to the engineer, charts or tabulations showing the contact areas and contact pressures for the full range of tire inflation pressures and for the full range of loadings for the tire furnished."

When such values are related to compacting performance on different types of soils under varying moisture conditions, it will provide the type of information needed to eliminate detailed equipment requirements in compaction specifications.

Nearly one-third of the states do not permit vibratory compactors and rollers, heavy pneumatic rollers, grid rollers or segmented pad rollers. The use of such rollers in half of the remaining states must be approved by the engineer. A large number of states, therefore, have no clear-cut provisions for use of some of the newer and more promising embankment compaction units.

New Developments and Applications of Compaction Equipment! There have been several significant developments in the design of compacting equipment in recent years. To begin with, self-propelled features have been incorporated into types which formerly were towed by individual power unit. This is particularly true in the case of pneumatic rollers.

The newest roller to join the self-propelled family is the sheepfoot type. Based on requirements for a large earthfilled dam, one manufacturer has designed and built a large self-propelled sheepsfoot roller comprised of four individual drums. Each drum is powered by an individual diesel engine with controls and operator's cab located midpoint on the machine. A similar unit using electric wheel propulsion and a single power unit has also been developed.

While self-propelled vibratory rollers have been developed in Europe for some time, it is only recently that an American manufacturer has marketed a self-propelled unit which has the capacity required for highway construction. The same manufacturer has also introduced a meter for measuring the resonance frequency of the materials being compacted. This permits the use of the most effective and economical vibration frequency.

It is often necessary to utilize several different compaction principles in achieving desired results. This fact seems to have been the incentive for the development of roller combinations which employ both static and vibratory rolling principles, or other dual features in the same unit.

One of the more recent is a 3-wheel tandem roller with vibration in a middle retractable roll. This roller has been successful in compacting granular base courses in lifts up to 9 in.

Minimum Contact Pressure on Tamping Feet

Number of States	2	1	1	5	16	2	2	1	1
Pressure (psi)	100	105	125	150	200	250	300	325	500

Another recent compactor combination is the 3-wheel roller with trailing shoe type compacting units. Such units have shown their ability to obtain densities in base course not achieved by the static roller alone.

A dual roller having both pneumatic and steel wheel rolling units was one of the first combinations developed. These rollers are now available with impact vibration on the steel roll at the operator's option, thus providing three types of compaction action when used individually and two combinations when used together.

Need More Equipment Performance Data: Undoubtedly one of the factors which contributes to some of the unreasonable equipment application requirements, prevalent in current construction specifications, is the uncertainty of equipment performance.

When a highway department specifies 10 or 15 passes with a compaction unit, it may indicate the engineers are not sure of the machine's capabilities, and have played it well on the safe side. It can be seen how much futile effort and taxpayers' money are expended if 4 or 5 passes with a modern compacting unit will provide the desired density. There is a need to obtain and distribute comprehensive, unbiased job performance data on all types of compaction equipment. These data are needed particularly on new developments which manufacturers find difficult to market, even though their machine is capable of superior performance.

Just how a contractor would select a vibratory compactor from the group now available on the market is a matter of conjecture. Nearly every vibratory roller has a different frequency range. Minimum frequencies vary by 200 percent, and maximum frequencies by about 150 percent. The range in the vibration frequency of the multiple shoe type compactors is of sufficient scope to affect their performance on various base course materials.

Although we have recently reached a better understanding of compactor tire performance, and in isolating the principal factor which affects compacting ability, more remains to be determined.

We need to know:

More about the effect of contact pressures on different soil types for varying moisture conditions and on flexible pavements.

And more about the effect of compactor tire size and wheel spacings, particularly when compacting deep layers of embankments and base courses.

Because of the lack of this basic performance data, we have not made full utilization of the capabilities of available pneumatic rollers between their minimum and maximum tire contact pressure range. For maximum efficiency we need to know what performance can be expected within the effective operation range of each type of compaction equipment.

Use of End-Result Specifications: If construction specifications are tied in to specific equipment requirements and procedures, their rapid obsolescence is assured since machinery design and application do not remain static. The advantages of newly developed and improved equipment cannot be realized if the output is limited to that obtained by the older models.

One deterrent to the more widespread use of end result specifications, in the compaction field, has been the lack of a rapid field test method for determining when the desired density or support is achieved.

End result specifications offer a challenge to the ingenuity of the highway contractor, and encourage the equipment manufacturer to develop machines which are capable of providing superior or more economical performance.

Conclusions: There is a need to bring about better understanding and agreement on the basic concepts involved in the compaction of highway embankments and surfaces.

There is considerable uncertainty as to the practicability of specifying any numerical density requirement until the moisture-density strength relationships have been determined for job conditions. Agreement on basic concepts could lead to the adoption of more uniform and realistic requirements for density or supporting value, and a greater standardization of equipment performance requirements.

Obsolete and restrictive equipment provisions should be eliminated from construction specifications and, wherever practical, replaced with end result requirements. While end result specifications would benefit both the highway contractor and the equipment manufacturer, it also places an additional responsibility on them and the highway department. Such a step would accentuate the need for more information on equipment performance within the available working range of each model or capacity class and possibly require higher trained technical personnel as construction inspectors.

The recently developed higher pressure truck tires are coming into general use. As they do it will be necessary to compact flexible base courses and pavements with equipment which is capable of exerting greater contact pressures than such tires exert in traffic. This will assure against permanent deformations in the wheel tracks of asphalt pavements subject to heavy traffic.

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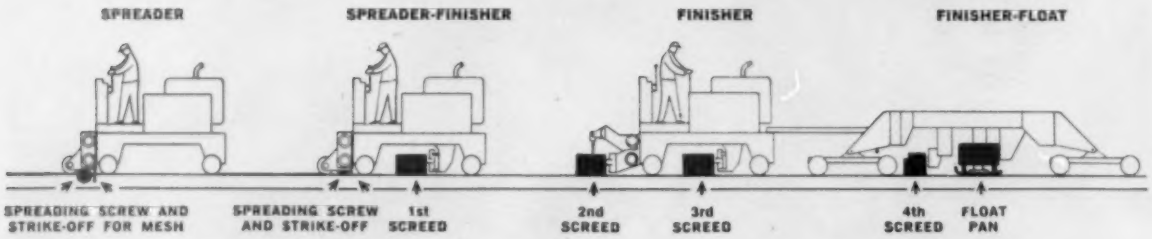

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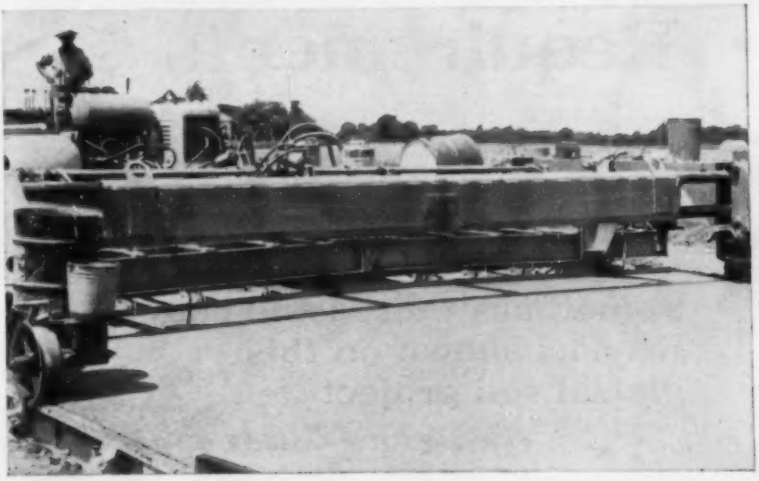

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A Roads and Streets Staff Field Report

Meeting Today's Highway Fill Requirements

Sometimes there is no easy way, as shown on this glacial soil project

When conditions were good, the American Construction Company's earthmoving fleet hit a 30,000 cubic yard or better daily pace on Route 1 Interstate near Painsville, Ohio, this past summer. Yardage was as high as 44,000 at times, double shift.

But the grading progress on this 5.72 mile dual-road job with its 2,700,000 cu. yd. of roadway excavation was plagued with soil problems. The delays due to soil and weather conditions necessitated reworking of some fill layers, extensive aeration and extra rolling. In other words, it affected the contractor's pocketbook.

If this job were just isolated example of a grading contractor's struggle for production under such difficulties, it possibly would not merit this review. On the contrary, this one typifies hundreds of highway grading jobs now under construction, or coming up for bids, where the contractor is having to face up to an exacting set of requirements.

Exacting requirements have been found imperative in getting a highway foundation that will carry heavy freeway traffic without differential pavement settlement.

Where the dirt is high-class stuff, and the weather is kind, a wide range of soils in the job will compact readily and pass test. The contractor can settle down to big daily yardages and routine rolling.

The following note appears on the plans for this project: "In addition to the requirement of (Ohio specification) Sec. E-101.08 (f) the moisture content of all embankment materials that display pronounced elasticity or deformation under the action of construction equipment shall not exceed optimum at the time of compaction."

This plan note is not new in Ohio. The same or

Seven pairs of sheepsfoot rollers, four with highly mobile towing units, were needed to keep up with earth wagon arrivals. Soil: good clay here. Problem: moisture.

similar requirement has been used on many other selected projects in Ohio, from time to time during the last 20 years. Projects selected for this requirement have been those where large quantities of A-4 silty soils were known to exist. Experience through the years, according to the Ohio engineers, has shown this requirement to be necessary for securing stable earthwork. As a result of this long and satisfactory experience, this requirement has now been incorporated into our 1959 specifications so that it will apply on all future projects, and the note on the plans will no longer be necessary.

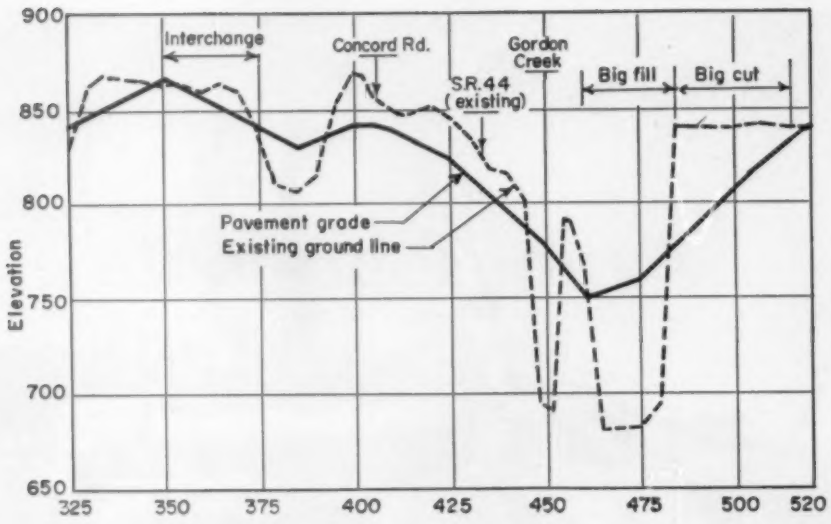
It is where borderline soils and/or unusually wet conditions are involved that the problems must be anticipated in the estimating, bidding and job planning.

Further compounding the grading contractor's problem from a national perspective, is the fact that each state's highway engineers have their own set of embankment requirements. These notes are best read at the same sitting with H. A. Radzikowski's specification review (published in this issue), which shows the state-by-state variables. Ohio's fill requirements are among the more exacting.

The job here reviewed is part of a complete package ($5.3 million) awarded in October, 1958, to Bates and Rogers Contracting Corporation, of Chicago. This firm sublet the 2,700,000 cu. yd. of grading to American Construction Company, Cleveland. American made a 400,000 cu. yd. autumn start, despite wet weather, doing light clearing, scalping topsoil and starting fill placement.

Work resumed mid-April of 1959. By August 15, a four-month production of 2,100,000 cu. yd. was accomplished despite weekly ups and downs. November 1 saw the job a bit behind, with cleanup in progress and paving started on some sections.

The fleet used was a mixed one, consisting of 1 Euclid 10BV belt loader with International TD24 pull and Allis-Chalmers HD-20 push tractor; 10



Grading profile of the Ohio Route 1 project, showing large cut and fill which gave most of the trouble.

bottom-dumps (International Payhauler 25-yd., and Euclid 14 yd.); 2 scrapers (LeTourneau-Westinghouse Bs and Euc TS24 twin-engine); 10 dozers (Cat D9s and D8s, Allis-Chalmers HD-20s and HD-21s, International TD24s); 6 motor graders (Galion T-600 Grad-O-Matic, Galion 60, Austin-Western, Cat 12, Adams).

Compacting equipment—the nub of this discussion—consisted of 4 dual 5-ft. drum sheepsfoot units drawn by rubber-tired LeT-Wesco Tournatractors; 5 similar dual sheepsfoot units drawn when needed by D8s; a Michigan 180 segment-shoe compactor; and for a time a 50-ton rubber-tired compactor and two small vibrating steel wheel rollers. Quick addition shows that this rolling fleet represented a considerable capital investment, well into the $200-$250,000 bracket.

The grading entailed, beginning from the east end, consisted of (1) a 75-ft., million-yard cut; (2) a 60-ft. million-yard fill; (3) on westward a 2-mile stretch of relatively shallow grading, chiefly cuts to 20 ft.; (4) then, at the west end, large fill yardage for an interchange area, where the accompanying photos were taken in late summer.

Relating this sequence of cuts and fills and general movement of dirt to the profile sketch (Figure 1), let us now look at the soils, all glacial in origin.

Soil Types. The chief soil in the big cut and filling operation at the east end was a Highway Research Board Classification A4 gray clay-silt (Ohio A4B). This soil, the poorest and most troublesome of the several encountered, was also the one involved in the contractor's spring and early summer start when the weather was prevailingly wet. It is a silt having high moisture retention, making good fill if sufficiently dry but a trouble maker otherwise. The contractor could waste this soil at his own expense, or wait for it to dry meanwhile "aerating the hell out of it." In general no waste or substitution was done.

At this point, let us also look at Ohio's sliding scale of maximum laboratory dry weight density vs. compaction requirements. The A4B soil which weighs 118 to 125 lb. per cu. ft. must be compacted to 95 percent density, as measured by the AASHO standard T-99 test method. This percentage went to 96 for the big fill and many other fill areas, under Ohio's specs which up the compaction one percent for all soils when embankments exceed 10 ft.

The contractor, in concentrating through April, May and June on the big east-end cut and fill, had to hold up often for material to dry out. Two heavy-duty Rome gang discs were worked constantly. Some layers had to be torn out and bladed aside even after rolling, and the layers beneath disced or exposed to sunny days, in order to meet the 95 or 96 percent density and the Optimum-plus-2-percent moisture limit imposed.

Actually, after the first summer weeks, the season turned out to be an exceptionally dry and sunny one. The contractor opened up his job, working cut progressively westward and lengthened out his hauls. But wherever that A4B material was encountered in any quantities—and there were pockets all through the work—everyone tensed for trouble. Skillful mixing helped meet requirements, but there were occasional slow-downs.

The contractor rolled under an open specification which permitted any kind of equipment. The sheepsfoot units used carried usually 225 psi foot pressure. Material for filling was required to be placed in lifts not exceeding 8 in. loose. Fills were kept well crowned for drainage, and were rolled from the center outward along the road axis. Blade

(Continued on page 114)

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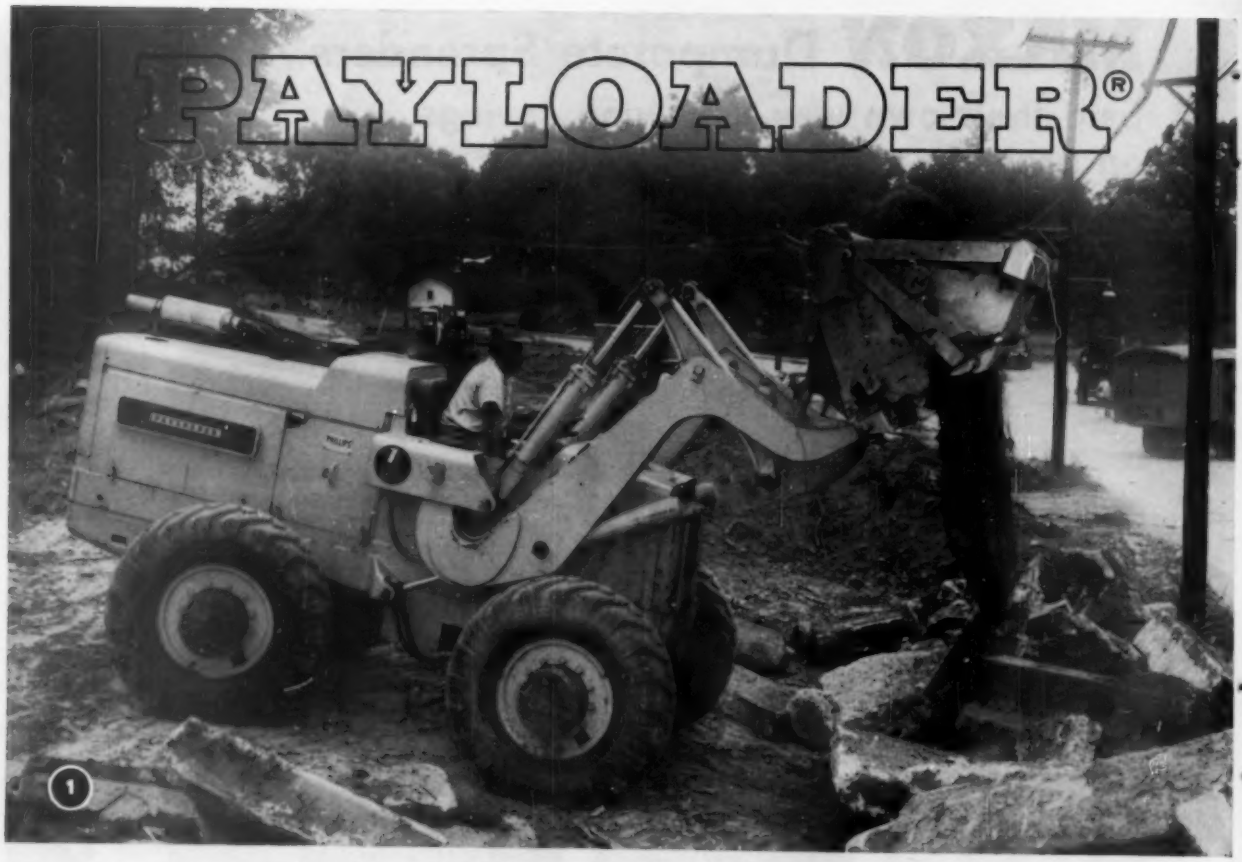

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No other tractor-shovel comes close to matching the all-around usefulness of a 4-wheel-drive "PAYLOADER" because it has the most complete selection of interchangeable attachments available, including several that are "exclusives" on "PAYLOADER" machines! These are *real working tools* that save time on-the-job and the high cost of single purpose machines:

1 "FOUR-IN-ONE" BUCKET

Patented Drott bucket is a "PAYLOADER" exclusive on rubber. Does many shovel, clamshell, scraper and bulldozer jobs.

2 HYDRAULIC BACK-HOE

Built exclusively for "PAYLOADER" by Wain-Roy. 190° working radius permits right angle dig and dump. Mounts front or rear.

3 FORK-LIFT

Forks adjust to fit varied size pallets or loose loads of lumber, sheeting, pipe, logs. Easily interchangeable with bucket.

4 ROTARY SNOW PLOW

Built by Ram for "PAYLOADER" tractor-shovels. Separate power unit drive. "V" and blade plows available also.

5 LEAF LOADER

Another "PAYLOADER" exclusive by Ram. Individual hydraulic motors power reel and conveyors. Picks-up 90% of bulk.

6 VIBRATORY COMPACTOR

Jackson vibrators efficiently develop specified densities in all granular soils. Electric motors on each of four 30-in shoes.

7 BLACKTOP SPREADER

Exclusive Ram unit has separate power unit. Lays up to 8-ft. wide, adjusts 0 to 48-in., 0 to 6-in. deep. 2-cu. yd. hopper.

8 SIDE-BOOM

Superior-Hough hydraulic boom lifts 5-tons, telescopes 10 to 16-ft. Does not interfere with bucket use.

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Steps in placing, processing and rolling wide interchange area: (1) Dozers on rough side of fill make initial spread. (2) Mobile rollers make several passes. (3) Rubber-tired roller-

High speed earth wagon fleet of American Construction Company posed problem increasingly familiar: how to meet stringent Interstate road embankment standards despite soil and moisture conditions that often say "slow 'er up!"

pullers do spreading, too, when strategic. (4) Segment-shoe roller makes forward-backup finishing passes, with or without blade skimming on the far side of the fill.

FILL REQUIREMENTS

(Continued from page 110)

turnover was done in conjunction with discing, and plenty of bladework often was needed to break up heavy chunky material or do blending. Good blading, in fact was good insurance toward getting the OK verdict on moisture-density.

Throughout the job, the Tournatractors gave a good performance as sheepsfoot pullers by virtue of their high-speed mobility, turn-around ability, and for the compaction contributed by routing their tire passages. Some, but not all, of the four Tournatractor-drawn roller outfits carried dozer aprons, and this dozing-while-rolling contributed to good layer manipulation as well as the getting of density.

The chief hour-to-hour problem was to see that excessively wet soil was not covered over and sealed in by too rapid placement and rolling.

Two other soil types figured in the job, neither a source of trouble. An A2-4 (Ohio specification) sandy silt and silty sand occurred in pockets, and an A6 (Ohio A6A and A6B) heavy clay and silty clay over much of the west end.

The former was blended systematically. The latter gave no trouble when properly drained and kept drained throughout the construction. It required some heavy blading to break up the chunky scraper and wagon deposits, and often the weight and tractive power of D8 pullers were welcome in sheepsfooting.

During the summer, and in late weeks when filling and rolling were concentrated on the big west-end interchange area (again see the photos), dirt was arriving at 30,000 cu. yd. per day, and six dual-sheepsfoot rollers were working full time to keep on top of the compaction. Crawler dozers spread along the dirt-arrival edge of a 250-ft. wide work area. Then the rubber-tired-dozer drawn tampers circled, working across from one side to the other to complete each lift before starting the next.

Next followed the Michigan 180 with segment shoes, making forward-reverse finishing passes, with a motor grader giving intermittent attention to the far side, in between trips over the haul road.

The point of interest was that, here in dry late-summer weather, compaction still wasn't being cheaply gained. The soils, a blend of the bad-acting A-4 with however the heavy A6 predominating, simply had to be rolled thoroughly. And the work could not get ahead of drying of the moisture-retentive material. The dirt had to be spread out over a sufficient working area to dry out, with or without use of the discs that always sat alongside in readiness.

Night-shift work particularly had to be watched, since it lacked the drying effect of sunlight. Night-time fill placement usually took extra rolling or had to proceed more slowly, or be confined to times when the material was right.

The contractor tried a 50-ton rubber-tired compactor, but only briefly. Also experimented with was a pair of self-propelled vibrating steel wheel rollers but the soil proved too wet and heavy for best results in the contractor's opinion. American's job hence was another one where the controversial sheepsfoot roller was king.

Administrative Quality Control. This project is one of a string of Interstate contracts being wound up in Ohio's push to complete their "Route 1" project diagonally southwestward across to Cincinnati. The state's lead position in the nation's Interstate program progress has been accompanied with a noteworthy effort to secure quality construction. Field control is centered in the state department's 12 divisions, with headquarters staff liaison. Some soil types, particularly silty soils with low plasticity, have unsatisfactory stability at moisture higher than optimum, even though compaction of

such soils meets specification density requirements. This was the case with the A-4 silt on American's job. It was necessary to place this silty soil in embankment at not more than optimum moisture. Ohio experience has proved clearly that such moisture control is the key to quality embankments, and effort has been made to explain this to the contractors to secure their full understanding.

The Ohio inspectors on American's work worked with all possible speed to cooperate on quick verdicts, needed by the contractor on moisture and density. The sand-cone method of making density determinations was used. Typical moisture-density curves prepared for Ohio soils, and based on over 10,000 Ohio determinations, aided the work.

The engineers kept a graph of the number of tests takings, which were run at the rate of a test for each 4,000 to 5,000 cu. yd. of material: A test took 30 to 45 minutes usually.

The state requested from time to time that the contractor bring in additional compacting equipment, a requirement permitted under the job specifications where satisfactory rolling is not being achieved or the work is falling behind schedule.

This project is under the Cleveland division of the Ohio Department of Highways, with William G. Henry as deputy director and division engineer. In charge for American Construction Company were Al Meister, project superintendent, and Hansen Green, vice president.

Ohio State Highway Specifications for Earth Embankments

Max. Lab. Dry Weight (lb. per cu. ft.)	Compacted Density (% of Std. AASHO, T-99)
Under 90	Not permitted
90 - 102.9	100
103 - 109.9	98
110 - 119.9	96
120 - over	95

For fills exceeding 10 ft. heights, 1% additional density is required for soils weighing 120 lbs. and more, and 2% additional density is required for soils weighing less than 120 lbs.

For top 12 in., compaction requirements for soil are 98% minimum, increasing to 102% for lighter soils, with no soil permitted here if weighing less than 103 lbs. per cu. ft. Moisture content for any soil must not exceed optimum plus 2%. Moisture not more than optimum is required for all embankment materials which display pronounced elasticity or deformation under the action of construction equipment.

Inspectors: Use Your Eyes

Learn to visualize poor soils during grading, Ohio field engineers and inspectors told

Contractors and engineers in nearly all states, particularly in those where moisture is a grading problem, will find interest in the following excerpts from a staff memo from E. W. Ellis, Engineer of Construction, Ohio Department of Highways.

Addressed to Division personnel responsible for construction control, it explains the necessity for tight control over moisture content during fill construction to insure stable embankments. It underscores the need to hold moisture to not more than optimum for silty soils which show pronounced elasticity or deformation under the action of loaded rubber-tired construction equipment. Maximum moisture has been recently liberalized to optimum plus 3 percent for certain clay soils which are stable at this moisture.

• • •

1. When heavy rubber-tired construction equipment moves over an embankment layer of wet fine-grained soil, some movement of the embankment surface occurs. One type of movement may be called elastic movement. The surface is deformed, and when the tire moves off the area, the surface rebounds or springs back with little or no rutting. Surface cracking may or may not occur, but usually occurs in cases of pronounced elasticity.

In the case of pronounced deformation there is displacement of some surface soil to each side of the tire, with resulting deformation, rupture, cracking and rutting. The magnitude of the elastic movement or deformation may depend on one or more of a number of factors: weight of equipment, tire size, tire pressure, soil moisture, type of soil, depth of soil layer, and stability of material underlying.

Some elasticity and deformation of embankment are expected under loaded rubber-tired construc-

tion equipment. Moderate movement occurs under heavy equipment on embankments of satisfactory stability, and such moderate movement is not considered detrimental. Greater movement under very heavy equipment is likely to occur over embankment showing adequate stability under heavy equipment commonly used. This is not detrimental except for specialized situations, such as soft foundation soil at shallow depth under the layer being observed. In general, greater movement under very heavy loads should be permitted without increased restrictions on moisture control.

It is not intended to use moisture control, under this specification section, to limit or restrict use of very heavy construction equipment on embankment construction.

2. The amount of elasticity and deformation permissible under any given load varies with job circumstances. For example, for the first layer over soft original ground embankment foundation, considerable movement under loaded construction equipment is inevitably due to the soft foundation material. The resistance to deformation is more critical in the top portion of embankment, near the subgrade, than in lower portions.

If succeeding embankment layers will involve low-stability material, such as wet silt, then elasticity and deformation of the layer being placed must be controlled more closely than would be necessary if succeeding embankment layers were high stability material such as rock, shale, granular material or dry soil.

Equipment which can be used successfully to test for embankment stability includes the following: rubber-tired roller, grader, loaded scraper, and loaded truck. Allowance must be made that more movement is to be expected under very heavy equipment than under heavy equipment ordinarily used in present highway work. When rubber-tired units such as scrapers, graders or rollers are being used generally over the entire area during normal embankment construction operations—and observation shows no area of questionable stability—it is not necessary to have a piece of testing equipment systematically cover the entire area for the specific purpose of observing stability. However, when the Engineer or Inspector questions or desires to check further the stability of an area during embankment construction, he is authorized to require the Contractor to move suitable equipment over the area for the purpose of checking for pronounced elasticity or deformation.

3. Determination of "pronounced elasticity or deformation under the action of loaded rubber-tired construction equipment" shall be based on the definition given in the first paragraph of Ohio specification Section E-1.08 (f). The administration of this requirement shall be tempered with sound judgment backed by construction experience. Decisions will be made at project level. Uniformity of application on projects shall be closely supervised by Division Construction Engineers, and policy between Divisions shall be supervised by Staff and Field Engineers of the Construction Bureau.

A word on the part of this Specification which requires that "moisture content in excess of optimum for material which displays pronounced elasticity or deformation under loaded rubber-tired construction equipment, shall be reduced in the amount necessary to secure stability" this is intended to control moisture in the range between optimum and optimum plus 3 percent only. In no case shall moisture greater than optimum plus 3 percent be permitted for any embankment soil; and in no case shall this part of the Specification be used to require moisture less than optimum.

In addition to the requirements for moisture set forth in this section, in every case specified compaction must be secured.

Moisture and compaction control are necessary and important to secure the satisfactory quality of embankments and subgrades necessary for long life performance of pavements in a sound and smooth condition.

Record-Size Portable Secondary Crusher

World's largest secondary crusher for portable operation is the claim made for this 60″ x 30″ Lippmann roll crusher, built for W. O. Pelphrey of Fort Worth, Texas. Demonstrating the high-capacity production possible with today's portable equipment this secondary plant, worked in conjunction with a 30 x 42 Lippmann portable primary plant, produced over 5,000 cu. yd. of material per day, hit as high as 7,575 cu. yd. in a single day's production.

Primary equipment at the Pelphrey operation included a 42″ x 35″ portable apron feeder; 4′ x 8′ heavy duty double-deck scalping screen; 30 x 42 Grizzly-King jaw crusher; 36″ x 30′ product discharge conveyor; and a 30″ x 12′ reject conveyor. Secondary plant utilizes a 36″ x 50′ feed conveyor; 60″ x 30″ roll crusher; 5 x 14′ triple deck screen; and two 24″ x 12′ reject conveyors.

Over 7,000 cubic yards of crushed material in a single day from this record-sized "secondary on rubber."

Here's another reason why Ford Trucks are your best buy!

"OF ALL THE MAKES WE'VE TRIED FORD TRUCKS GIVE US THE LOWEST MAINTENANCE COST!"

ANOTHER REPEAT BUYER OF FORD TRUCKS

Virgil E. Cook, owner of Cook Block and Brick Co., is convincing proof that there is still plenty of opportunity in American business for those sound planning, hard working individuals who want to own their own business. Starting from scratch just 13 years ago, he now owns and operates one of the largest concrete products plants in Eastern Indiana. The workhorses in his fleet of 16 trucks are three Ford Tilt Cab Tandems that are used to haul sand and gravel to the plant and make deliveries in and around Anderson.

Hard-working Ford CT-950 tractor leaves Cook gravel pit with 18 yards of aggregate. Aluminum walking beam and rubber suspension system of tandem axle assembly reduce chassis weight, permit higher legal payloads.

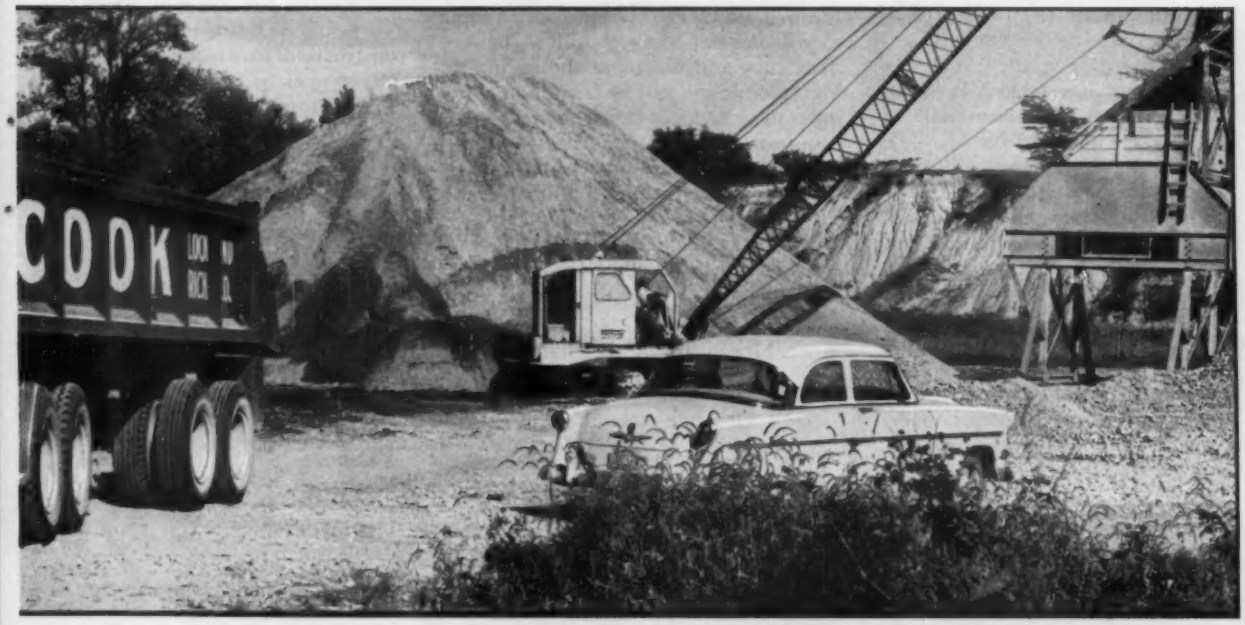
Cook's CT-850 with special flat-bed body and Side-O-Matic unloader delivers blocks right to the job site. Unit carries 600 concrete blocks and spots them where needed.

"Our experience has proved that Ford Trucks can be operated at substantially lower maintenance costs than any other make we've tried. And, equally important in a fleet like ours, we find that our Fords spend much less time in the shop. None of the Ford units purchased since 1958 have been in for major repairs and I am still amazed at the way the older ones keep going.

"The best truck we've ever owned is a 1954 Ford C-700 that consistently carries a load of 350 to 400 blocks over all types of terrain. In spite of this severe work it ran 125,000 miles before we replaced the engine. This unit now has over 140,000 miles on the original ring gear and pinion and it went 60,000 miles before we relined the brakes and put in a new clutch. This is outstanding mileage when you consider that we've realized as little as 12,000 miles from competitive ring gear and pinion sets. Clutch and brake life obtained with other makes in identical service was only 20,000 miles. It's results like this that keep our costs low and convinced us that we should stay with Fords when we bought our bigger trucks in '58.

"Our 1958 and 1959 Ford Tilt Cab Tandems give every indication of equalling or surpassing the fine records set by the C-700. The two CT-950 tractors hauling sand and aggregates to our processing plant breeze through traffic and take the hills like they weren't there at all. Our CT-850 equipped with a flat-bed body has the power and traction to deliver finished products anywhere. With Ford's tilt-cab design we get a real plus as far as payload is concerned because we can carry at least 2,000 pounds more weight on the front axle.

"We buy Ford Tilt Cab Trucks because we think they're the best engineered and most modern gasoline trucks in the heavy-duty field. Here at last is a truck built to permit big legal payloads with enough power to move these loads at economical speeds. We pride ourselves on our modern and efficient equipment and consider our Fords one of the most valuable assets of our business."



'60 Fords are built for longer life . . . with Certified Durability!

Whatever your job . . . wherever you do it . . . you'll discover just as Mr. Cook did, that Ford Trucks are the best investment for your transportation dollar.

Certified results of tests conducted by America's leading independent research organization (name available on request) confirm the fact that Ford Super Duties have been refined for still more durability! Automatic radiator shutters, improved electric fuel pumps and redesigned wiring harnesses are typical of the advancements to be found in these units.

Automatic radiator shutters reduced the coolant temperature variation recorded in severe mountain road tests from a 79° range to a 20° range. Engine operation with coolant temperatures in the 167° to 187° range means less expansion and contraction, more efficient combustion and better lubrication . . . all of which contribute to longer engine life.

Dynamometer tests showed *no vapor lock* with Ford's submerged-type electric fuel pump at temperatures up to 200°. Incipient vapor lock with mechanical fuel pump resulted in a power loss of 9% under the same conditions. Shaker table tests plus constant exposure to oil, water and heat proved 1960 wiring harness to be *three times longer lived.*

FORD TRUCKS COST LESS

LESS TO OWN . . . LESS TO RUN . . . BUILT TO LAST LONGER, TOO!

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1960 OUTLOOK

Continued from page 65

lic Roads has put all of the state highway departments under contract controls, more nicely known as "reimbursement planning." Much has been made of the announcement that during *Fiscal Year* 1960 (July 1, 1959, to June 30, 1960) total state highway department obligations for federal-aid construction will be held to $3.1 billion (federal funds plus state matching). This would be a sharp 21 percent drop from the $3.9 billion which the states actually obligated for construction during the previous 12-month fiscal period.

What the industry needs to realize, however, is that the cut-back which the Administration sought to make in state highway department awards to relieve the Highway Trust Fund, has largely been accomplished, and the lean half of fiscal 1960 is now past history. The next six months should see a rapid recovery. Here's why:

The BPR has planned it so that two-thirds of the total $3.1 billion Fiscal 1960 construction money was reserved for obligating during the next six months. Thus, the states will have nearly $2.1 billion to put to work between now and July 1 for initiating actual contract work. This is *double* the amount made available for construction over the six-month period just ended.

Figure 2 shows the spurt in obligations for construction on federal-aid systems which will be possible in the *next* six months, compared to the *last* six months.

It is not likely that this "snap-back" flow of federal funds will be maintained. The BPR has not announced officially how much the states will be permitted to obligate in the last half of Calendar 1960, but the unofficial word is that the Bureau will be able to advance $1.5 billion to the states for federal-aid projects during that period. Matching money will raise this to $2 billion, and of this total $1.6 billion will be slated for construction.

Of course, what we are talking about here is the availability of funds nationwide. Actual contract awards are not likely to follow the sharp ups and downs as shown in Figure 2. It will not be possible for some state highway departments to transform into contracts the sums available to them as rapidly as Figure 2 shows for the first half of this year. Likewise, they are not likely to follow the let-down in federal-aid funds in the 1960 calendar second half.

More Money for Some States

Although the federal contract controls hit some states hard during the last half of 1959, others are still not caught up to the pace set by the regulation and will have plenty of money to put to work.

Six eastern examples are Maryland, Virginia, Pennsylvania, Rhode Island, New Jersey, and the District of Columbia. Here is how much each obligated for construction in Fiscal Year 1959 and the sum available to them in Fiscal 1960:

	Fiscal 1959	Fiscal 1960
Pennsylvania	$88.8 million	$114.5
Maryland	16.6	49.3
D. C.	10.4	22.7
Rhode Island	11.1	13.2
Virginia	50.0	91.4
New Jersey	62.4	74.0

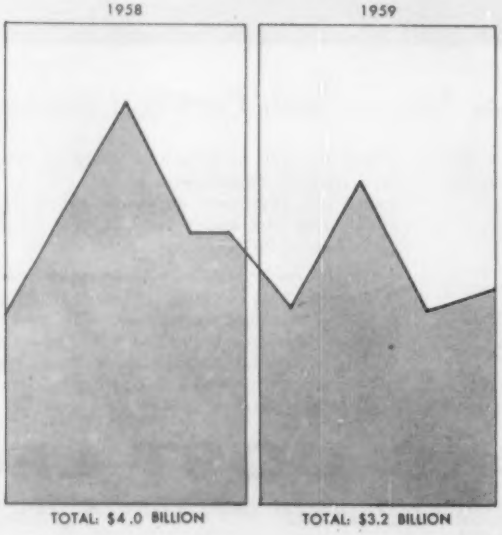
Other states which will have more or nearly as much to obligate for construction in Fiscal 1960 as they put to work in Fiscal 1959 are: Alaska, California, Nebraska, New Mexico, North Carolina, Vermont and Puerto Rico.

Most states will be putting their 1st half funds into contract lettings far into the 2nd half, so that the national contracts volume will probably assume a more gradual upward climb through the year.

But, by 1960 year's end, money for federal-aid construction obligations will have built up to $3.7 billion, and this may be the better figure to plan by. It reflects a hefty

FIGURE 1

Zig-Zag State Road Letting Picture



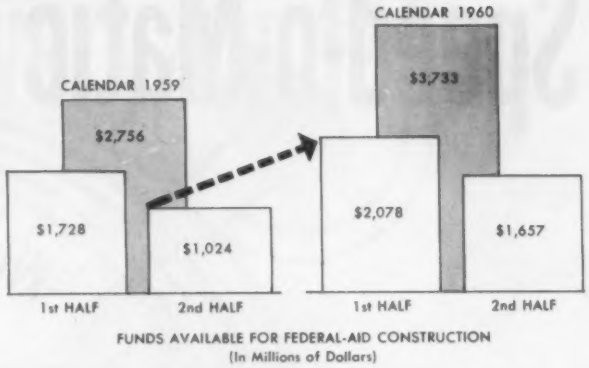
Bureau of Public Roads Figures (in Thousands) for Monthly Award Totals

	1958	1959	
January	$ 184,142	294,462	
February	200,571	227,882	
March	254,974	244,685	
April	324,800	292,334	
May	354,498	338,486	
June	410,504	382,674	
July	473,685	338,303	
August	468,009	227,953	
September	381,666	200,737	
October	361,147	212,131	
November	318,580	200,000	(Est'd)
December	325,142	200,000	(Est'd)
	$4,055,718	$3,159,647	

FIGURE 2

Federal Fund Flow, Showing Recovery

Strong shot of federal-aid funds during the next six months is expected to boost total of 1960 construction well over 1959. Here is the pattern of available money (for state highway construction only; right-of-way and preliminary engineering stripped away). These sums included state matching.



FUNDS AVAILABLE FOR FEDERAL-AID CONSTRUCTION
(In Millions of Dollars)

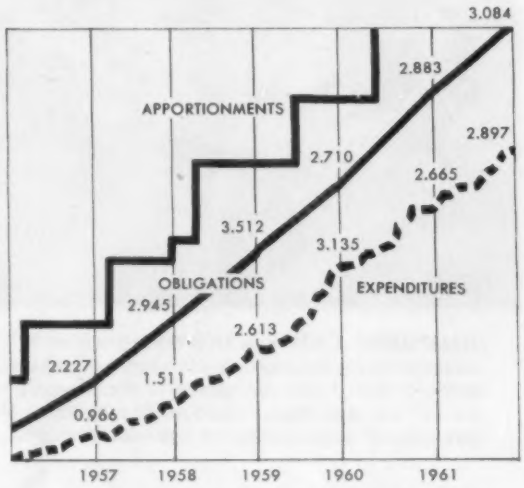
FIGURE 3

Looking Farther Ahead: Steady Climb?

New money under the Federal-Aid Act of 1959 will—even under contract controls—permit a steady rise in the National Highway Program.

F.A. Funds Available Under 1959 Act

Fiscal Years	Apportionments	Obligations	Expenditures
1957	1.129	2.227	0.966
1958	2.559	2.945	1.511
1959	3.581	3.512	2.613
1960	3.410	2.710	3.135
1961	2.683	2.883	2.665
1962	2.884	3.084	2.897
1963			2.911



(FIGURES IN MILLIONS OF DOLLARS)

35 percent increase over calendar 1959, a good indication of the potential strength of the recovery.

These are reasons why the consensus among highway leaders here in Washington is that things are definitely looking up.

The accompanying analysis, it should be reminded, is based on *the amount of money which will be made available* to the 50 state highway departments under the federal contract controls program. How much of the $3.7 billion forecast here will be turned into *actual contract awards* will depend upon the usual state-level factors. Many states—perhaps most of them—will be able to pick up all Uncle Sam lays on the table and wish they had more. Others have been behind and show continued signs of an inability to put all of their federal-aid money to work. So, actual contract awards—as a proportion of the money available to them—will vary from state to state.

The Long Look Ahead

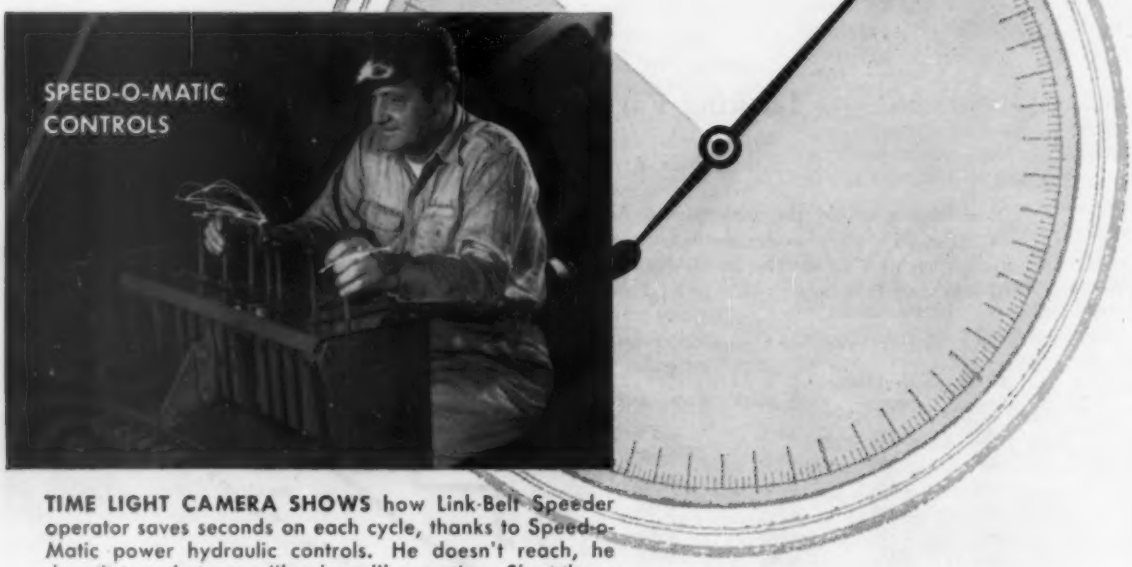
Taking a longer look ahead, there is always the chance, of course, that national economic or international developments will cause the White House to order another "cooling off" in roadbuilding. Nothing of that serious a prospect is now in sight. As for Congress, the legislators must give continued support to the road-building program and make periodic financial drafts if the $40-billion Interstate System is to be advanced to completion.

It will be another 12 months before the economic studies now under way in the Bureau of Public Roads and based on the AASHO test road are completed, however, and Congress can take little action this year. A year from now the legislators will be faced with some very controversial taxation problems. How they resolve these problems of highway-user benefits and

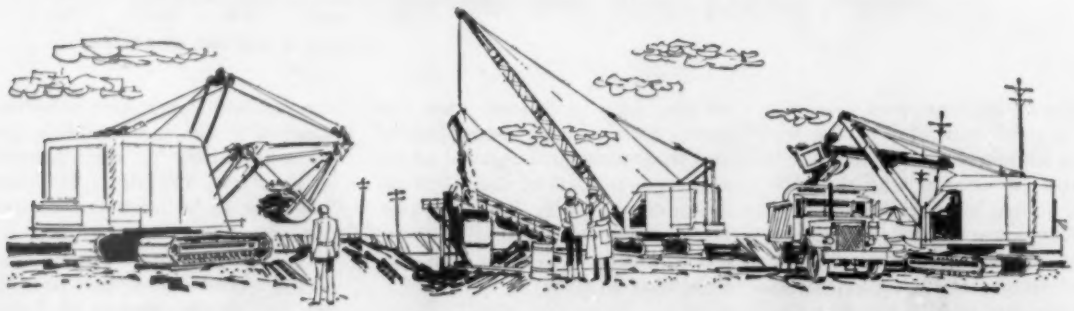
Continued on page 124

One time-honored fact about ***LINK-BELT SPEEDER*** *shovel-cranes*

Speed-o-Matic controls save



TIME LIGHT CAMERA SHOWS how Link-Belt Speeder operator saves seconds on each cycle, thanks to Speed-o-Matic power hydraulic controls. He doesn't reach, he doesn't tug. Just easy, "key-board" operation. Short-throw levers boost output, conserve operator strength.

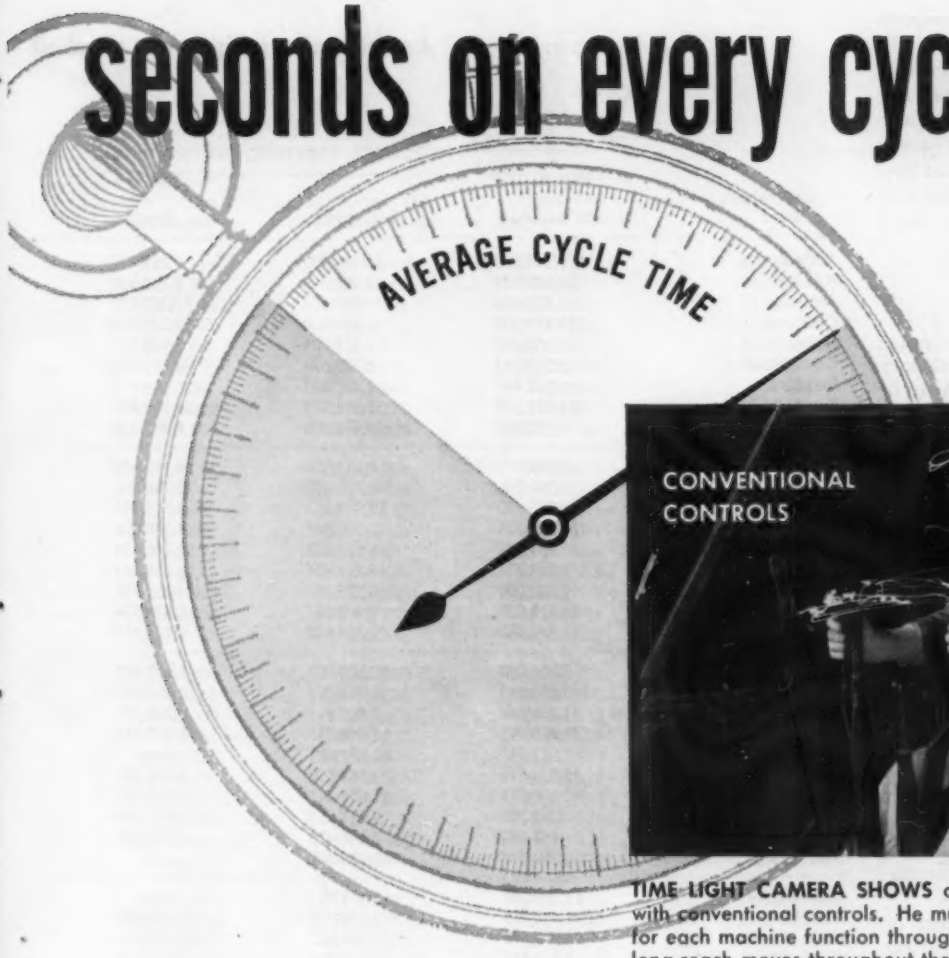


You're really on fast time when you clock Speed-o-Matic . . . actually gaining up to 25% more cycles per working shift. You make important production time savings all day long over outdated manual or booster long-throw controls that require extra linkage adjustments . . . that work against the operator, compounding end-of-shift fatigue.

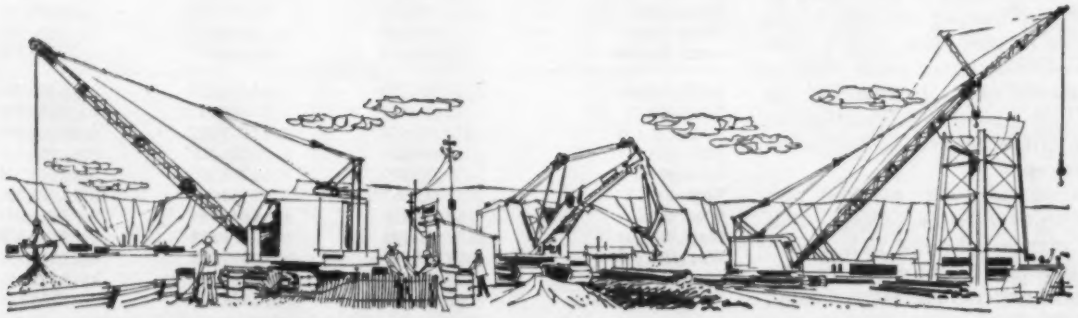
A Link-Belt Speeder operator is more relaxed, more confident at the short-throw, easily accessible controls. He nudges a lever, flicks his wrist and *instantly* the powerful machine responds with oil-smooth assurance and agility. He feels it through his fingertips — working — without jump, jerk or lag. Oil under pressure does the brute work; he supplies the coordination.

Speed-o-Matic is standard on the Link-Belt Speeder line of performance-plus shovel-cranes. Find out for yourself why these machines have more profit-winning features, *why they produce more.* See your distributor, or write LINK-BELT SPEEDER CORPORATION, Cedar Rapids, Iowa.

seconds on every cycle!



TIME LIGHT CAMERA SHOWS operator caught in the act with conventional controls. He must move long-throw levers for each machine function throughout each cycle. It's these long-reach moves throughout the day that rob him of valuable seconds . . . cut his daily output . . . drain his vitality.



109-59N

LINK-BELT SPEEDER

It's time to compare . . . with Link-Belt Speeder

. . . for more details circle 328 on enclosed return postal card

1960 OUTLOOK

Continued from page 121

taxes will determine the prospects for future construction after 1961.

Again, observers here feel that the possibility of an increase in federal aid is more likely than a reduction. In the meantime, however, the course which the big road program is taking under the 1959 Federal-Aid Highway Act is indicated in Figure 3.

1,400 New Contractors

In 1959: No matter how much work the state highway departments turn out, it never seems to be enough to satisfy the contracting industry. With their built-in capacity for quick expansion, contracting firms are always on the prowl for more work. And the economics of mechanized equipment production usually justify the addition of "just one more" job.

Furthermore, it is not difficult to get into the business. Pre-qualification practices in many states have had the effect of encouraging new businesses, rather than primarily determining the experience and ability of the low bidder to finish the job at the price he bid. This is one reason why the peak awarding months of 1958 produced literally hundreds of new contracting organizations.

1959 saw the average number of bidders per advertised federal-aid project rise from 6.5 to 7.4.

The Bureau has no later statistics—which would be interesting indeed—but during the first eight months of 1958 alone, nearly 1,400 *new* highway contractors bid on federal-aid work. In short, within that eight months, the roadbuilder force in this country swelled a full 25 percent.

Furthermore, 502 of these new contractors were low bidders. This may explain why low bids during the first half of the year ran 11.3 per cent under engineers' estimates.

This was a major development back of the competition picture in 1959.

In 1960: It is speculative how many of those new firms have survived the famine of the last six months or can complete their first jobs at a profit. The Dun & Bradstreet reports do not indicate any great rise in fatalities among highway contractors. The assumption is that when the spring jobs are advertised, there will probably be a stiff demand for construction plans.

How State Road

Latest available figures as supplied

State	Calendar, 1958 (12 Months)	(1st Half)	(3rd Quarter)
Alabama	$ 77,337,933	$ 32,895,987	$ 19,349,810
Arizona	33,027,035	18,904,489	9,760,345
Arkansas	41,315,500	18,687,322	12,230,000
California	249,579,000	120,256,000	56,027,800
Colorado	50,812,000	14,817,804	2,910,000
Connecticut	52,569,552	13,729,674	27,200,000
Delaware	15,847,341	2,752,841	None
Florida	128,328,028	57,038,778	32,759,608
Georgia	113,753,000	39,876,000	8,908,093
Idaho	28,900,995	9,184,064	4,164,815
Illinois	240,000,000	108,800,000	70,100,000
Indiana	103,935,475	30,952,167	26,511,712
Iowa	106,601,923	46,940,041	14,500,000
Kansas	80,633,513	33,552,207	12,240,434
Kentucky	114,321,771	37,794,804	8,458,864
Louisiana	116,293,000	46,524,000	17,058,499
Maine	36,125,589	7,407,501	2,674,644
Maryland	51,381,362	19,263,486	4,795,300
Massachusetts	115,000,000	40,100,000	5,300,000
Michigan	145,690,531	94,845,200	18,656,000
Minnesota	75,303,560	27,605,450	9,990,000
Mississippi	35,460,905	32,246,215	6,056,841
Missouri	97,527,745	52,833,621	None
Montana	36,352,715	11,968,656	4,368,433
Nebraska	40,656,171	17,431,418	7,625,000
Nevada	18,534,759	5,217,559	1,872,000
New Hampshire	31,442,440	8,660,476	6,063,000
New Jersey	57,090,017	45,996,667	——
New Mexico	39,249,207	17,173,981	None
New York	290,830,000	114,030,000	34,995,882
North Carolina	62,901,519	35,394,562	20,107,011
North Dakota	39,257,147	30,913,354	6,989,000
Ohio	280,960,000	40,187,500	22,893,445
Oklahoma	89,078,567	3,356,914	17,922,015
Oregon	64,258,977	21,785,787	3,888,705
Pennsylvania	217,186,713	41,772,196	13,531,146
Rhode Island	17,528,624	2,258,333	1,826,000
South Carolina	75,552,675	35,834,201	13,533,596
South Dakota	30,402,753	14,130,831	10,870,208
Tennessee	82,884,127	27,445,398	7,950,299
Texas	262,120,833	154,379,222	68,009,400
Utah	31,500,000	21,000,000	250,000
Vermont	19,291,000	16,278,000	10,011,143
Virginia	76,269,937	25,568,460	5,191,000
Washington	67,274,750	34,841,154	3,615,211
West Virginia	52,345,123	15,675,918	5,941,308
Wisconsin	90,856,000	37,399,000	21,939,152
Wyoming	37,490,075	12,798,399	3,095,669
District of Columbia	17,636,141	10,848,556	224,176
TOTALS	$4,498,795,928	$1,709,354,183	$ 662,335,564[1]

[1] Figures complete except for New Jersey. [2] Figures complete except for Pennsylvania

Construction Cost Level

In 1959: Last year saw highway construction costs ride a fairly level course. In fact, although the Cost-

Programs are Coming Along

from the state highway departments to Roads and Streets.

CONSTRUCTION CONTRACT AWARDS			PAYMENTS TO CONTRACTORS		
Calendar 1959 (4th Quarter) Estimated	(Entire Year as Originally Planned)	Entire Year Estimated Actual	Calendar 1958	(1st Half 1959)	Entire Year 1959 Estimated
$ 12,693,135	$ 92,895,987	$ 64,938,932	$ 47,637,379	$ 23,965,478	$ 60,800,000
9,000,000	40,904,489	37,665,834	31,317,617	16,155,186	32,000,000
10,600,000	47,374,442	41,517,322	28,273,469	11,279,247	30,750,000
49,713,900	260,256,000	225,997,700	215,044,000	89,926,000	226,650,000
6,800,000	41,817,804	24,527,804	52,014,320	18,230,156	40,390,000
13,500,000	60,429,674	54,429,674	86,977,190	24,911,706	49,500,000
1,300,000	7,752,841	4,052,841	20,937,845	11,752,045	13,500,000
23,400,000	117,038,778	113,198,386	91,274,100	56,314,500	110,000,000
17,500,000	99,876,000	66,284,093	68,604,796	33,419,538	77,000,000
3,083,958	28,784,064	16,432,837	17,464,237	9,285,585	24,369,000
25,000,000	260,000,000	203,900,000	168,400,000	65,400,000	195,200,000
6,811,201	107,452,167	64,275,080	48,719,686	18,722,446	68,995,000
11,400,000	115,000,000	72,840,041	96,768,519	27,526,283	108,400,000
7,460,022	80,052,207	53,252,663	64,147,375	27,912,845	71,500,000
17,000,000	142,794,804	63,253,668	57,995,632	37,397,905	101,000,000
14,000,000	100,000,000	77,582,499	80,434,000	56,904,000	105,000,000
5,200,000	29,407,501	15,282,145	23,735,988	9,175,098	24,500,000
15,500,000	48,263,486	39,558,786	46,103,790	18,293,360	49,500,000
8,000,000	53,400,000	53,400,000	—	—	87,539,000
16,600,000	183,545,000	130,101,200	134,500,000	48,100,000	—
13,600,000	47,465,450	51,195,450	52,807,605	20,501,186	58,824,997
6,889,453	60,646,215	45,192,509	34,119,288	17,775,370	42,973,405
23,061,276	121,911,321	75,894,897	90,955,999	37,404,542	82,876,000
3,478,148	41,968,656	19,815,237	30,704,491	9,361,730	32,391,888
4,000,000	35,000,000	29,056,418	39,579,828	9,892,374	33,000,000
600,000	17,217,559	7,689,559	13,906,216	6,833,384	15,220,000
6,573,000	23,521,476	21,296,476	20,650,167	9,303,820	25,457,000
—	114,037,147	70,000,000	41,422,188	21,008,342	—
7,000,000	40,173,981	24,173,981	41,221,957	23,998,211	39,160,000
84,488,816	336,030,000	233,514,698	244,678,000	134,776,000	347,500,000
4,598,607	69,121,562	60,150,180	62,934,464	22,759,783	65,859,954
1,650,000	51,413,354	39,552,354	36,764,370	8,905,856	39,005,000
67,062,518	150,587,500	89,955,963	215,311,481	67,865,817	236,000,000
5 340,780	30,504,555	26,619,709	62,640,478	35,239,129	61,000,000
9,615,159	54,785,787	35,289,651	37,542,953	19,516,326	55,700,000
9,903,086	—	65,156,428	175,961,241	91,016,487	193,768,000
969,000	23,938,333	5,053,333	13,899,417	4,664,107	11,820,000
5,479,687	70,834,201	54,847,484	75,500,000	35,800,000	56,500,000
4,400,000	42,130,831	29,401,031	24,184,731	13,108,972	36,816,000
23,810,897	59,206,594	59,206,594	60,577,397	29,010,876	71,456,494
36,631,120	294,379,222	259,019,742	231,763,268	125,219,056	273,820,104
6,200,000	44,000,000	27,450,000	32,500,000	14,000,000	28,700,000
3,715,188	33,278,000	30,004,231	7,569,704	4,162,248	14,951,331
22,182,000	109,769,260	52,941,460	61,406,191	26,484,822	57,000,000
6,500,000	74,841,154	44,956,365	62,230,746	19,616,997	49,650,000
5,288,100	31,144,794	26,905,326	28,748,306	14,831,125	44,800,000
8,750,000	89,399,000	68,088,152	65,023,553	18,782,354	82,000,000
7,289,836	36,798,399	23,183,904	34,343,800	13,052,565	33,950,485
8,169,592	27,780,325	19,242,325	15,000,000	7,798,114	15,428,433
$ 661,808,479[1]	$4,049,929,820[2]	$3,017,000,000	$3,429 297,782[3]	$1,467,360,371[3]	$3,582,222,091[4]

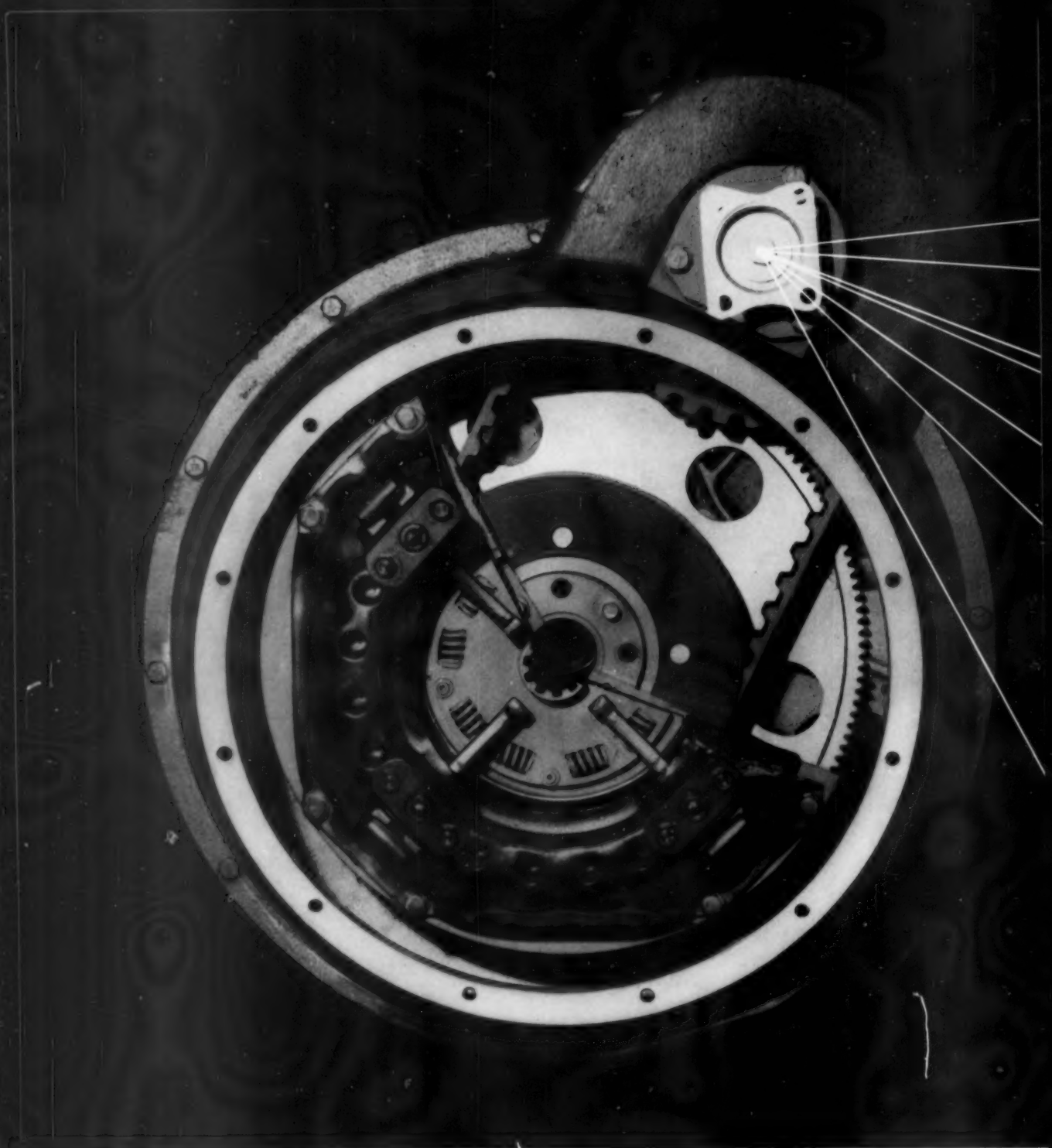
[3] Figures complete except for Massachusetts. [4] Figures complete except for New Jersey and Mass.

of-Living index rose 2.6 percent during this period, highway construction bid prices dropped 2.2 percent. The taxpayer is still getting a full dollar's worth of new road.

The pattern of bid prices on federal-aid highway work in recent quarters is revealed in Figure 4.

In 1960: No one wants to predict what will happen to costs during the coming year. If it were possible (as in other industries) for the producer to pass its increased costs au-

Continued on page 140



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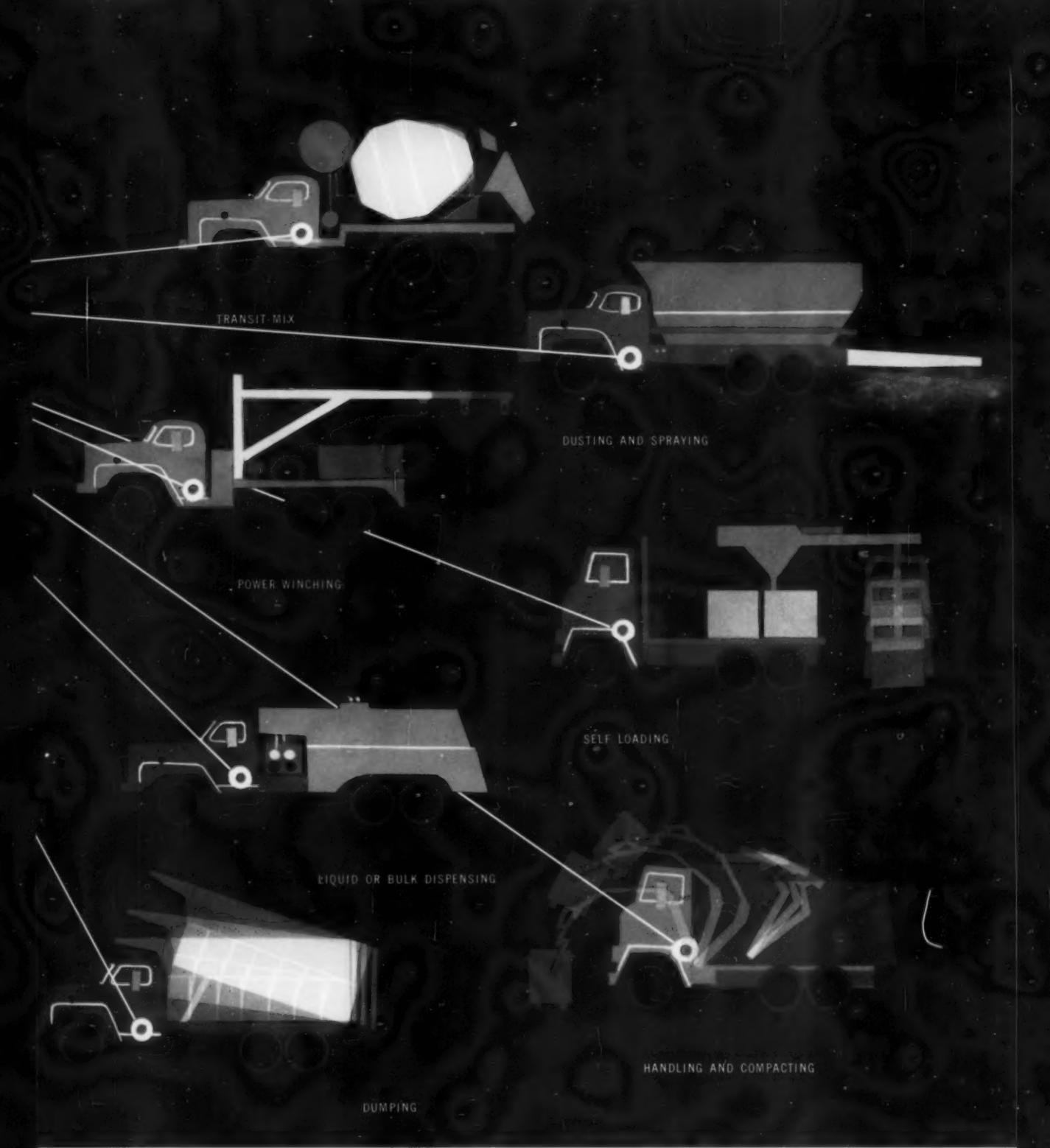


Reo's compact Flywheel P.T.O.—proven in transit-mix operation—
is now available *as an integral part of the chassis engine drive*
in custom Reo vehicles for a host of specialized uses. Perhaps yours.

If you have a power take-off application, contact your Reo representative.

REO DIVISION, The White Motor Company, Lansing, Michigan.

Gold Standard of Values

HYSTER

Newest winch equipment for Caterpillar-built tractors...

HYSTER has it!

Everything new but the name—completely redesigned — more rugged — simpler to operate and maintain. Four new models for Cat D9, D8, D6 and D4 tractors—available for direct and torque converter drive or power shift machines. Details from your Caterpillar-Hyster dealer or write Hyster Company now.

Caterpillar and Cat are registered trademarks of Caterpillar Tractor Co.

TRACTOR EQUIPMENT DIVISION—Construction and logging equipment.
INDUSTRIAL TRUCK DIVISION—Lift trucks, mobile cranes, straddle carriers.
MARTIN TRAILER DIVISION—Heavy machinery hauling trailers.
INTERNATIONAL DIVISION—Overseas manufacturing, sales and service.
FACTORIES: Portland, Oregon (Home Office); Danville, Peoria, Kewanee, Illinois.
Sao Paulo, Brazil; Glasgow, Scotland; Nijmegen, The Netherlands; Sydney, Australia (Licensee)

. . . for more details circle 317 on enclosed return postal card

HYSTER

HYSTER COMPANY
TRACTOR EQUIPMENT DIVISION
Post Office Box 328, Peoria, Illinois

NEW PRODUCTS

Listed here are reviews of new and improved equipment items, selected to aid our readers in purchasing. See reader service numbers on enclosed postcard.*

Case Tractor Shovel

Tractor Shovel

The most powerful model in their line of four-wheel drive tractor shovels has been announced by the J. I. Case Co. Called the W-12 Terraload'r, this high-production unit has a carry capacity of 9000 lb., breakout capacity of 23,500 lb. Its standard loader bucket is SAE rated at 2½ cu. yd. However, optional buckets with SAE rated capacities of 1⅝ and 3½ cu. yd. are also available. Patterned after the W-9 and W-10 Terraload'rs, the new unit is designed around a 120 hp diesel engine and integrates engine and tractor shovel into a single unit. This tractor shovel has torque converter drive that automatically triples engine output torque to meet increasing loads; the constant mesh transmission provides speeds from 0 to 23 mph in either direction through three speed ranges.

J. I. Case Co., Racine, Wis.

For more details circle 101 on Enclosed Return Postal Card.

Self Trailing Roller

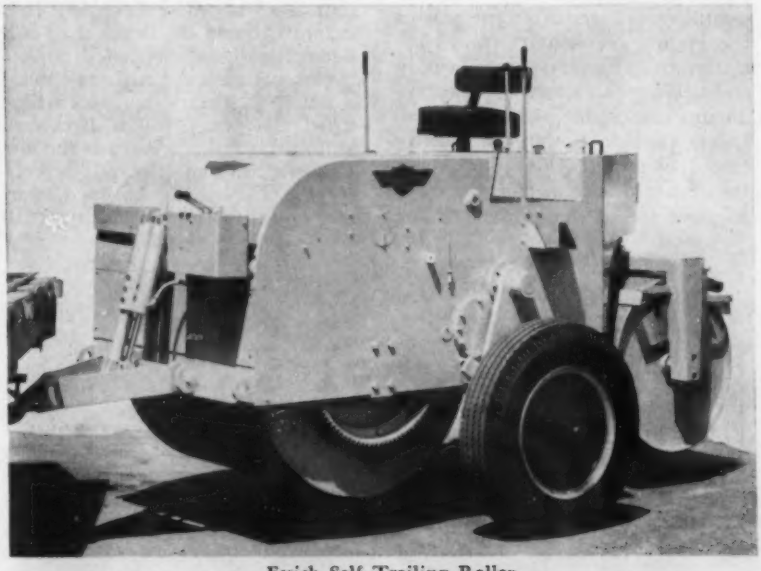
Hydraulic operation of self-trailing wheels for maximum portability is offered by the new model 650-C 2-wheel Essick tandem roller, weighing from 4½ to 6½ tons.

During rolling operations, the travel wheels are retracted upward to a high position, offering maximum clearance. For the few instances where close wall clearances are necessary, the travel wheels can be quickly and easily removed. 3-way wheels can be quickly and easily removed; wheel support lock ensures maximum safety during all types of trailing situations. Fingertip manipulation of two individual valves control the power to operate the trailing mechanism.

The new model 650-C roller has dual controls accessible from either of the two seat positions, with hydraulic steering lever located between seat positions; a 4-cylinder line, 32 hp Continental water cooled engine; compression roll which produces 228 lb. per lineal inch compression with water ballast.

Essick Manufacturing Company, 1950 Santa Fe Ave., Los Angeles 21, Calif.

For more details circle 102 on Enclosed Return Postal Card.



Essick Self Trailing Roller

*To readers outside of the United States—postal rules forbid use of business reply cards outside of the U.S. Please write to us listing the numbers, month and name of magazine, and mail with your name and address to Inquiry Dept., Roads and Streets, 22 W. Maple St., Chicago 10, Ill., U.S.A.

New Products

Allis-Chalmers TS-360 Motor Scraper

Motor Scraper

A new all-hydraulic TS-360 motor scraper with 30 cu. yd. heaped capacity and 22.3 cu. yd. struck capacity has been introduced by Allis-Chalmers Mfg. Co. This 63,150-lb. unit is powered by the A-C turbocharged 21000 engine, which develops 340 hp at 2,000 rpm.

Double-acting hydraulic bowl lift jacks assure powerful force at the cutting edge for penetration into tough-loading materials. Hydraulic power is furnished by a tandem pump, gear-driven from the rear of the engine crankshaft to provide instant controlled response for positive steering and scraper operations. Twin, telescoping, hydraulic cylinders provide power for positive forced ejection. Rams push from the center of the ejector for more effective use of this power; As the ejector moves forward, the apron raises to a 10-ft. opening, assuring ejection of all types of material.

Allis-Chalmers Mfg. Company, Tractor Group, Milwaukee, Wis.

For more details circle 103 on Enclosed Return Postal Card.

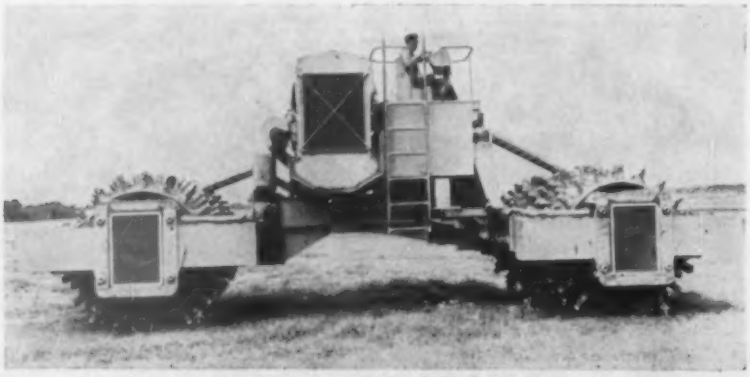
Giant Compactor

This giant "earth packing" machine resembles an old-time steam roller but has hundreds of flat, circular "feet" which grind into the earth to give a required degree of hardness. The new sheepsfoot roller, announced by R. G. LeTourneau, Inc., is self-propelled; an operator sits atop the unit and mans a panel of electric controls which drive the heavy rollers backward and forward over an area at the rate of about 300 fpm. Because the rollers are electrically powered, they can travel both directions with identical speed and power. Any number of trips can be made over the area without having to turn the machine around.

The machine measures 28 ft. long, 14 ft. wide, 12 ft. tall and weighs 40 tons. It has independently oscillating drums, 5 ft. long and 5 ft. in diameter, that are driven by d.c. electric motors geared to the inside rims of each drum.

R. G. LeTourneau, Inc., 2399 S. MacArthur, Longview, Tex.

For more details circle 104 on Enclosed Return Postal Card.



LeTourneau's Earth Packer

Portable Scale

The Douglas Homs Co., announces development of a new type of completely self-contained portable weighing scale suited for highway and general construction control work as well as all applications where scale portability is essential.

It is stated that the portable scales are suitable for field density, compaction and all other soils engineering determinations, as well as concrete aggregate weighings and bituminous test procedures. Special features of the scales include a full capacity beam permitting use of entire scale capacity without the addition of loose weights.

Homs Portable Scale

The portable scales are available in capacities of from 51 lb. to 300 lb. graduated in fractions of ounces, ounces and in 1/10 of pounds as well as metric scales from 25 kg. to 150 kg. capacity. All units can be supplied with blank or graduated tare beams. Tare beams graduated 1 lb. by 1/100 of a pound are also available.

Douglas Homs Company, 326 Jackson St., San Francisco 11, Calif.

For more details circle 105 on Enclosed Return Postal Card.

Crawler-Tractor

A new crawler-tractor, the "103", from the Eimco Corporation is offered with GM Diesel's 4-53 engine. The unit is reported to have a maximum drawbar pull of 33,000 lb. with zero track slippage.

The crawler-tractor is equipped with independent track control with individual full reversal on each, constant-

Eimco Crawler with GM Diesel engine

ly running power take-off drive, and an independent hydraulic pump drive that allows simultaneous use of hydraulic, winch and hoist accessories.

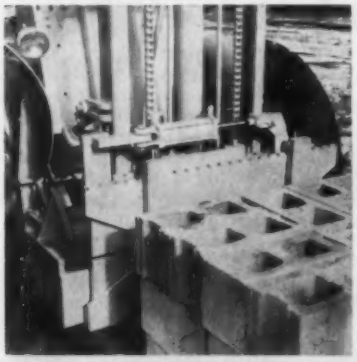
Eimco Corporation, P. O. Box 300, Salt Lake City 4, Utah.

For more details circle 106 on Enclosed Return Postal Card.

Spot-Loading Attachment

For more accurate spotting of palletized or concrete block loads without multi-pass positioning, J. I. Case Company is offering a new "side shift attachment" for its 4,000-lb. capacity Model M-420 wheeled fork lifts.

The new attachment allows for shifting of loads 3 in. to right or left, regardless of the heights of the forks, at the movement of a dash-mounted, short-throw lever. Once the attachment has been installed, subsequent removal or reinstallation involves only removing or replacing set screws and changing hose connections. There are 3 variations on the basic attachment: one for the 10 ft. 6 in. masts, another for the 14 ft., 3 in. masts and a third for the 21 ft., 6 in. masts. Weight of the attachment will not materially affect the fork lift's capacity because it is mounted close to the mast, the manufacturer states.

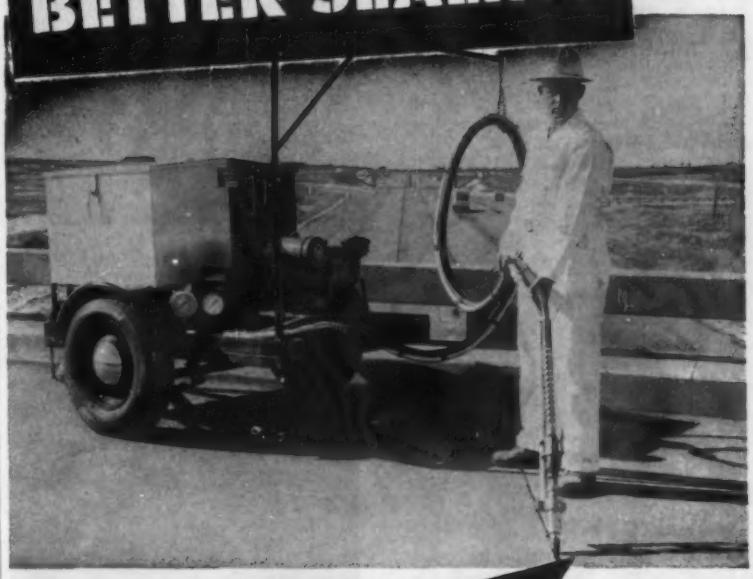


Case Spot-Loading Attachment

J. I. Case Co., Industrial Division, Racine, Wis.

For more details circle 107 on Enclosed Return Postal Card.

BETTER SEALING



ALLIED Jet Seal GIVES

BEST PROTECTION AND APPLICATION

Allied JET SEAL Product 9015H was developed to answer the specific needs of highway engineers for a rugged, economical and easily applied joint sealant. JET SEAL has no flow—even at elevated temperatures. Ideal for inclined and vertical surfaces. It will prevent penetration of water into joints and is highly resistant to highway salts. Allied JET SEAL Product 9015H will also prevent incorporation of incompressible materials.

Adhesion, cohesion, resilience and ductility at low temperatures (−20°F) is assured with JET SEAL. The original special equipment exclusively developed by Allied to apply JET SEAL automatically proportions, mixes and places the material, which cures rapidly.

Write for additional information . . . Product 9015H.

ALLIED MATERIALS CORP.

PRODUCERS, REFINERS AND COMPOUNDERS OF SPECIAL ASPHALT PRODUCTS

ALLIED BUILDING • 5101 N. PENNSYLVANIA • P.O. BOX 7103
39th St. Station • Oklahoma City 12, Oklahoma
Plants: Stroud, Okla. • Detroit, Mich. • Los Angeles, Calif.

. . . for more details circle 276 on enclosed return postal card

New Products

Winch and Hoist

A new, portable electric winch and hoist, capable of lifting 1500 lb. has been announced by City Engineering Co., Inc. Weighing only 57 lb., the "My-Te" all purpose electric hoist operates from any 30 amp, 110 volt ac circuit and will handle a variety of pulling or lifting jobs in the construction field.

City Engineering Hoist

Portability of the new lightweight hoist is insured by its compact size; the unit is only 27 in. long, 12 in. wide and 14 in. high. Lifting capacity is 750 lb. on a single line and 1500 lb. on a double line. Drum speed is 59 rpm. and drum capacity is 150 ft. of ¼ in. cable. The gear ratio is 280 to 1.

City Engineering Company, Inc., 3547 Massachusetts Ave., Indianapolis 18, Ind.

For more details circle 108 on Enclosed Return Postal Card.

High Speed Hole Saw

A new "Moly" high speed hole saw has been added to Clemson Bros. metal cutting tools line. Made of tough steel, the new, shatterproof saw features high speed cutting edges capable of cutting clean, round holes in materials from 9/16 in. in diameter to 6 in. in diameter.

It is designed for use with both portable power tools or machine tools. A feature of this saw is its all-welded construction; the edge is welded to alloy-steel back; the back in turn is welded to the steel body. The saw cut's outside diameter is slightly larger than the diameter of the body. This allows the saw to follow completely through its own hole, and enables cutting of stacked material.

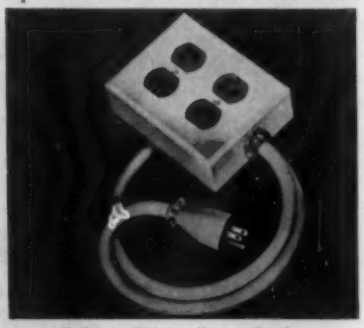
Clemson Bros. Hole Saw

Star Hack and Band Blades, Clemson Bros., Inc., Middletown, N. Y.

For more details circle 109 on Enclosed Return Postal Card.

Outlet Box

This new outlet box from The Ericson Manufacturing Company accomodates as many as four power tools, lights, etc., with No. 14 cable in 25 or 50-ft. lengths. Six different outlet receptacles are available. The box is made



Ericson Heavy Duty Outlet

of metal and covered with a thick coating of yellow colored plastic which as a high dielectric strength, and is oil and chemical resistant; The yellow color is highly visible for safety purposes.

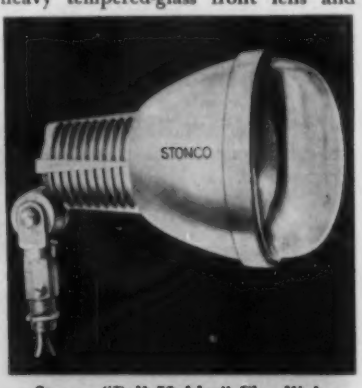
The Ericson Manufacturing Company, 1660 Hayden Ave., Cleveland 12, Ohio.

For more details circle 110 on Enclosed Return Postal Card.

Vaportight Floodlight

The new heavy-duty "Bell Holder" by Stonco Electric Products Company, is said to be completely vaportight for use in locations exposed to moisture, ice, corrosive fumes, non-explosive vapors and gases or non-combustionable dusts.

Fully protected and sealed with a heavy tempered-glass front lens and high-temperature live silicone-rubber gasket, the new unit is said to be especially effective for the wide-range of failure-prone installations in tunnels, bridges and other locations where unusually severe conditions are damaging to ordinary floodlights.



Stonco "Bell Holder" Floodlight

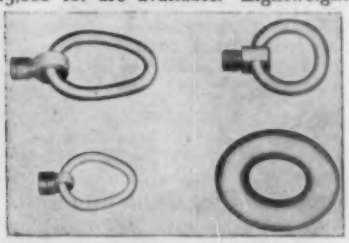
Stonco Electric Products Company, 333 Monroe Ave., Kenilworth, N. J.

For more details circle 111 on Enclosed Return Postal Card.

Tie-Down Equipment

These tie-down ring assemblies, plate nuts and eyebolts can be used in handling cargo of all types on trucks and trailers and can be used with canvas webbing, wire and rope.

Capacities of 5,000 lb., 10,000 lb. and 25,000 lb. are available. Lightweight



Puritas Tie-Down Aids

lunette has maximum rated draw-bar pull of approximately 30,000 lbs. Workmanship of welding, heat treating, magnetic inspection and finish meet U. S. military specifications, the manufacturer states.

Puritas Metal Products Company, 16116 Puritas Rd., Cleveland 35, Ohio.

For more details circle 112 on Enclosed Return Postal Card.

Asphalt Ripper

A new hydraulically-operated rear mounted ripper, designed to rip asphalt pavements to a 12 in. depth, has been announced by the American Tractor Equipment Corporation. The ripper is for exclusive use on Model 660 and 550 motor graders manufactured by LeTourneau-Westinghouse Company, Adams Division.

The ripper, which can accommodate up to seven ripping shanks, is mounted to the motor grader's rear frame where the weight and hydraulic power provide fast penetration and efficient ripping in the toughest material. The design and contour of the ripper shanks lifts and breaks the material for easier handling and tends to com-

ATECO ripper on L-W Grader

press the motor grader's tire for better traction. However, the ripper does not replace the front mounted scarifier which is necessary for scarifying around obstructions, manholes, etc.

LeTourneaux-Westinghouse Company, Peoria, Ill.

For more details circle 113 on Enclosed Return Postal Card.

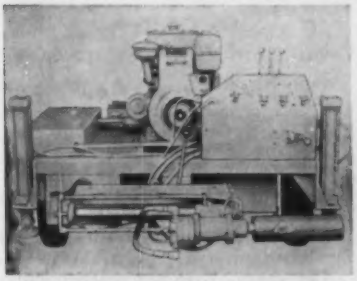
Coring Machine

The new Mobile Drill Mark V pavement coring machine is designed for production-type coring on highways, aircraft runways and other slab-type masonry structures.

Because of its lightweight, one-piece design, the unit can be mounted on or demounted from any ¼ ton truck or trailer in a matter of minutes. Two-point hydraulic suspension reduces set-up time to a minimum. The hydraulic drill motor accommodates diamond bits from 2 to 10 in. in diam. The self-powered machine has a 3-way hydraulic drive that permits coring through steel reinforced concrete at the rate of 30 sec. per in. "Hydro-Cushion Control" automatically maintains the correct drilling pressure and rate of feed while compensating for minor changes in the hardness of materials.

Mobile Drilling, Incorporated, 960 N. Pennsylvania Ave., Indianapolis 4, Ind.

For more details circle 114 on Enclosed Return Postal Card.



Mark V Pavement Coring Machine

Hydraulic Power Unit

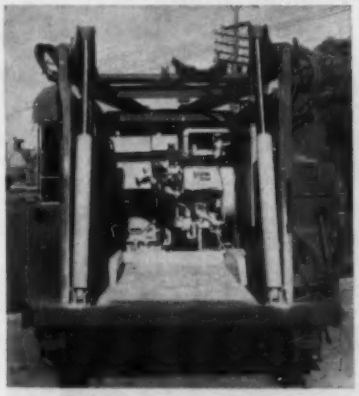
A unit designed to power all the hydraulic equipment needed on a utility construction body has been made an integral part of the new "Uni-Power Body" manufactured by Holan Corporation. Holan builds the body, power plant and all hydraulic equipment as a unit. The complete unit is then bolted to the chassis.

The "power package" consists of a 56 h.p. Wisconsin 4-cylinder air-cooled engine, a Braden Model CL Hydraulic Winch and a tandem hydraulic derrick, winch, digger and supporting jacks.

The compact power unit—located just behind the crew compartment in the bed of the body can be lifted out as a unit or by component parts for repair or replacement without removing the body. All hydraulic piping is done under the floor of the body and clear of the chassis.

Holan Corporation, 4100 W. 150th St., Cleveland 35, Ohio

For more details circle 115 on Enclosed Return Postal Card.



Holan "Power Package"

High Capacity Conveyor

A new high capacity conveyor from the Fairfield Engineering Company is designed primarily to work with auger drills and in handling non-abrasive materials. Its high capacity, up to 210 tph, will handle the output of the largest augers in use today, the manufacturer states.

The unit can be attached to the auger so that it moves as the auger is moved to the next location. The con-

DYNA-MIGHT Battery-Operated

instant up-and-down action

MONARCH

POWER HYDRAULIC CONTROLS

for snow plows

HY-LO-JACK

One man controls the plow from the cab . . . instant up-and-down action with the flick of a wrist. Snow removal is easier, faster, more economical with Monarch. See your dealer. Write for illustrated folder.

HY-LO FOR JEEP Fan-Belt Driven

MONARCH ROAD MACHINERY COMPANY
1331 Michigan St., N.E. Grand Rapids 3, Michigan

. . . for more details circle 333 on enclosed return postal card

LOOK FOR FUNK reversomatic® DRIVES on the equipment you buy!

Get smooth, instant power shifting — both forward and reverse, or lift and lower—with JUST ONE LEVER.

FUNK MFG. CO. BOX 577-H COFFEYVILLE, KANSAS

. . . for more details circle 307 on enclosed return postal card

New Products

Fairfield Conveyor

veyor is rubber mounted and has discharge heights ranging from 10 to 17 feet. Flight speed is 120 fpm. Optional features include hydraulic steering, hoisting and chute swing. A choice of electric motor, gasoline or diesel engine is available to fit the job and location.

The Fairfield Engineering Co., Marion, Ohio

For more details circle 116 on Enclosed Return Postal Card.

Backhoe Attachment

A backhoe attachment that facilitates digging through rock or hard, frozen ground has been announced by the American Hoist and Derrick Company.

Utilizing a one way hydraulic cylinder fastened to the top of the mast, the cylinder piston is secured to the backhoe boom forward of the boom seat. The unit contains an oil reservoir with a flexible hydraulic line from the reservoir to a valve and then on to the cylinder; its operation is automatic. With this attachment, as soon as the operator starts his inhaul, the hoist line goes slack. The slackening of the hoist line actuates the hydraulic valve, locking the oil in the cylinder. This makes the cylinder act as a solid connection between the boom and the mast or backstay; to force the boom upward almost the entire machine has to be raised off the ground, with the pivot point being just under the rear driving sprocket. Thus, almost the entire machine can be used in forcing the dipper teeth into the surface.

American Hoist Backhoe Attachment

American Hoist & Derrick Company, 63 S. Robert St., St. Paul, Minn.

For more details circle 117 on Enclosed Return Postal Card.

Tamping Roller

Shovel Supply Company announces Model SP-22, self-propelled double-drum tamping roller. Equipped with drums 5 ft. in diameter, 6 ft. long, each drum is provided with feet 9¼ in. long; the unit meets all requirements of the U. S. Corp of Engineers and the Bureau of Reclamation.

Shovel Supply Tamping Roller

Power to each drum is supplied by General Motors Model 4-71, 125 hp diesel engine, Allison 3-speed transmission, torque converter and heavy duty roller chain; final drive running in oil, provides speeds from 0 to 8 mph., forward and reverse. It is equipped with cleaners front and rear, hydraulic steering and powerful air brakes. Feet with removable caps are furnished when desired.

Shovel Supply Company, Inc., P. O. Box 1369, Dallas 21, Texas

For more details circle 118 on Enclosed Return Postal Card.

Two-Way Radio

Gonset Division, Young Spring & Wire Corp., has announced a new G-12 multi-channel "Citizens Communicator" 2-way radio. The new C-12 operates within the 26.965 to 27.235 megacycle Citizens Band recently assigned by the Federal Communications Commission for business or personal use.

The unit is a complete 2-way radio station. Four crystal-controlled channels for both transmitter and receiver provides fullest operational versatility; various stations in system, such as cars, trucks, etc. can be assigned different channel frequencies. Desired channel is selected by front-panel switch. Full press-to-talk control by push switch on microphone.

Gonset 2-Way Radio

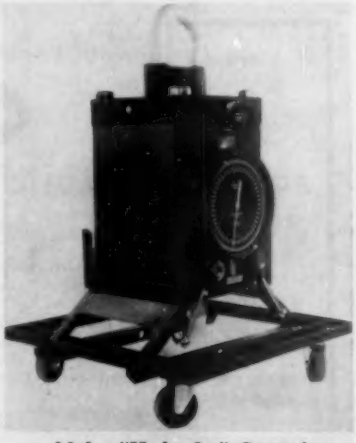
Gonset Division, Young Spring & Wire Corporation, 801 S. Main St., Burbank, Calif.

For more details circle 119 on Enclosed Return Postal Card.

Crane and Hoist Control

The "Hydra-Set," auxiliary crane and hoist control instrument, manufactured by Mefco Sales & Service, Inc., is available in 50 and 100 ton capacities. The unit is installed as a link between the crane hook and the load, and is entirely self contained requiring no air or outside hydraulic lines for operation.

The control operates independently of the crane or hoist system and places control in the hands of an operator having personal observation of the parts being handled. Loads up to 100 tons can be raised or lowered a distance of 12 in. with accuracy to within one-thousandth of an inch. Fast, accurate load leveling is accomplished with a high degree of component and personnel safety, the manufacturer states. The instrument is available in 1, 2½, 5, 10, 20, 50 and 100 ton capacities; larger models can be ordered.



Mefco "Hydra-Set" Control

Mefco Sales & Service, Inc., 131 N. 5th Ave., Arcadia, Cal.

For more details circle 120 on Enclosed Return Postal Card.

L-W's New Tandem Scraper

"Monro-Matic" Shock Absorber

Tandem Scraper

A new line of LeTourneau-Westinghouse tandem scrapers is available behind all three sizes of the company's Tournapull prime movers as well as the 4-wheel Speedpull. Total capacities with the tandems range from 18 cu. yd. in the D. size to 56 cu. yd. in the model B.

Coupling or uncoupling the second scraper is said to be easily accomplished in 30 minutes or less. One hitch pin forms the mechanical connection, while quick connect plug-ins provide hook-ups for electrical cable and air hose. Electric controls for the rear scraper transmit the power for tailgate, apron and bowl lift through electric cable eliminating long runs of wire rope. Maneuverability is not hampered with tandems, states the manufacturer. For instance, a Model D. Tournapull with tandem scrapers totalling 18-yd. capacity can make a 180-deg. turn in less than 32 ft. 7 in.

LeTourneau-Westinghouse Company, 2301 N. E. Adams St., Peoria, Ill.

For more details circle 121 on Enclosed Return Postal Card.

Grade Attachment

The "Lev-L-All" attachment that turns the Massey-Ferguson 202 Industrial Tractor into a grader, maintainer and leveler, is announced by Massey-Ferguson Industrial Division.

The unit is said to match the work output of any single-purpose 50-hp tandem motor grader in its weight class. Standard equipment includes hydraulically-operated leaning front wheels and lateral shift. Maneuverability is supplied by the long wheelbase and short turning radius; the 145 degrees of turn on the circle allow close positioning for "pulling a ditch." Turning radius of the 21 ft. 5 in. rig is 28 feet.

M-F "Lev-L-All" Attachment

Massey-Ferguson Industrial Division, Block 1000 South West St., Wichita, Kansas

For more details circle 122 on Enclosed Return Postal Card.

Shock Absorbers

New, heavy duty shock absorbers for trucks and off-road equipment have the same adjustment qualities as passenger car shock absorbers, announces the manufacturer, Monroe Auto Equipment Company.

Known as "Monro-Matic" shock absorbers, the units utilize the company's patented 3-stage valve which, on compression and rebound is said to give a smooth gentle control of springs while on paved roads and quick positive control on rough roads. Features include a heat-treated rod guide bearing "Park-o-Lubricated" piston and a sawaged, hardened pressure tube. For special applications, variations of the shock absorber can be supplied.

Monroe Auto Equipment Company, Monroe, Mich.

For more details circle 123 on Enclosed Return Postal Card.

Diaphragm Pump

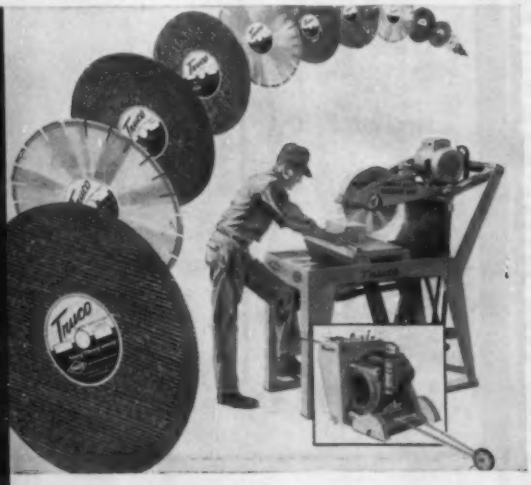
The addition of four new diaphragm pump models to their "Torrent" line of centrifugal pumps has been announced by the Hale Fire Pump Co. The line, consisting of 1¼

Continued on page 137

NEW *Truco*® JOB-MATCHED SAWS AND BLADES CUT SAWING COSTS

LOOK FOR THIS MARK

TRUCO



Here's a quick, easy way to save money. On your next masonry sawing job, see your Truco distributor and get Truco JOB-MATCHED Blades—matched to *your* job for cutting speed, blade life, safety, economy. He has the exact combination that *you* want and it will save you time and money. See those new Truco JOB-MATCHED Saws, too—the most versatile saws ever built. Write for distributor's name and literature. TRUCO MASONRY DRILLING DIVISION, Wheel Trueing Tool Co., 16B3200 W. Davison, Detroit 38, Michigan

SEE OUR NEW PRODUCTS • BOOTHS 97-98-99 • M.C.A.A. SHOW

ASK FOR ON-THE-JOB PROOF

. . . for more details circle 346 on enclosed return postal card

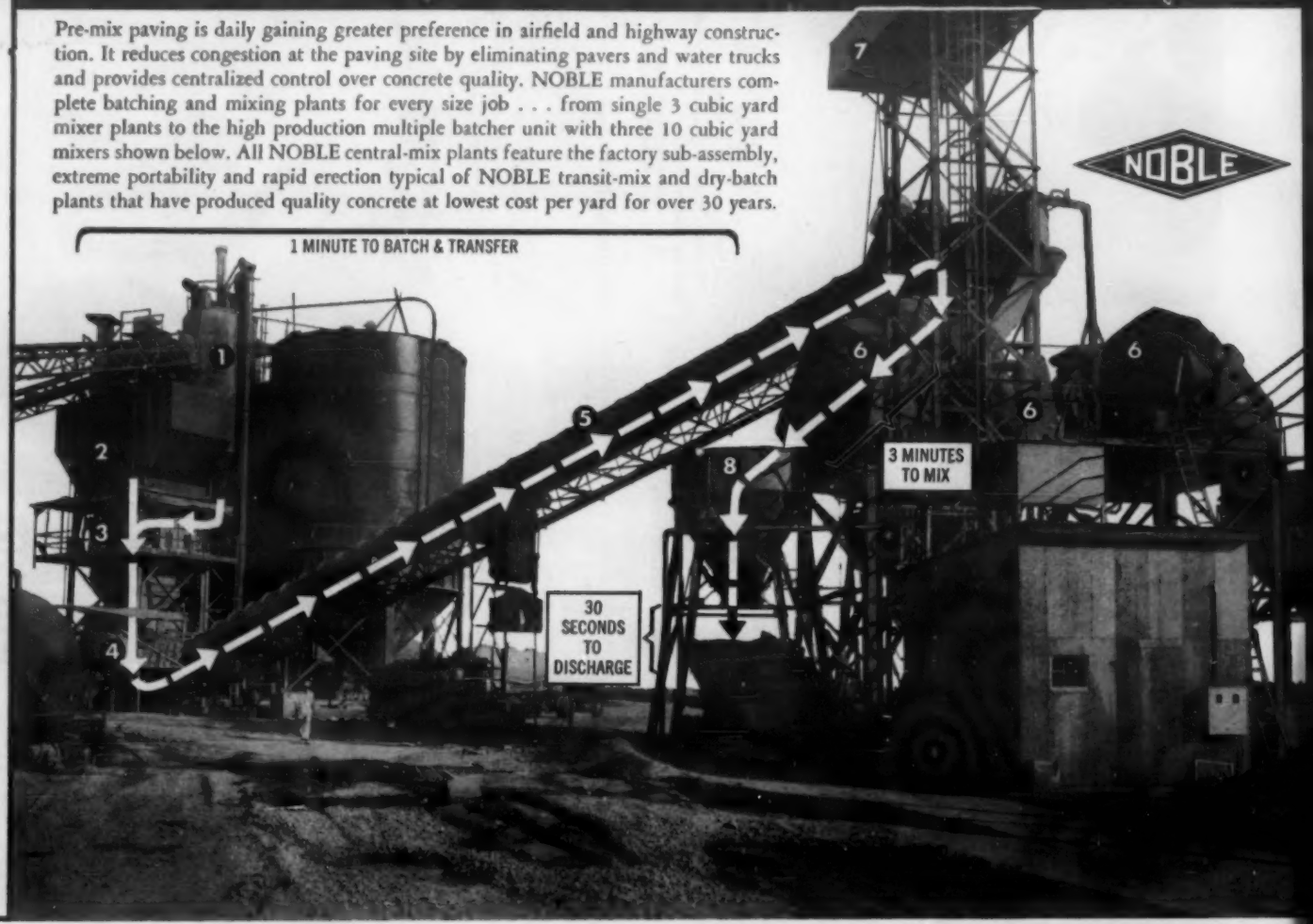
NOBLE CENTRAL-MIX BATCHING PLANTS SPEED HIGHWAY & AIRPORT PAVING

500,000 cubic yards of concrete for the $19,000,000 Chantilly International Airport, Washington, D. C., runway and taxiway construction represents the first paving job of this magnitude supplied from a central-mix concrete batching plant: C. J. Langenfelder & Son, general contractor. Producing 30 cubic yards of pre-mix concrete in 4½ minute cycles, this particular NOBLE central-mix plant features:

1. 600 barrel cement batching silo charged pneumatically. Overflow to two 7500 barrel storage silos. Cement recirculated from storage to batching silo by two 12" vertical screws.
2. 200 tons of rock and sand stored in 3 separate compartments charged by three 30" x 155 ft. NOBLE belt conveyors.
3. 5 automatic batchers in center section sub-assembly (3 for aggregates, 2 for cement) weigh materials simultaneously and accurately for a complete 10 yard batch. Push-button controls for batching and discharging into holding hopper. Automatic interlocks prevent batching to holding hopper with gates open. Extreme accuracy is assured by photo-electric "over-under" indicators of NOBLE beam scales and positive cut-off by automatic louvre gates on two high-speed cement feed screws.
4. Pre-blending of sand, aggregates, cement helps reduce subsequent mixing time to only 3 minutes.
5. 60" wide, 250 hp batch transfer conveyor alternately charges . . .
6. three 10 cubic yard Smith tilting mixers.
7. Water batching and distribution of dry materials from conveyor to proper mixer is controlled from tower. Water pumped up to scale from ground storage.
8. Three 20 cubic yard wet-mix holding hoppers provide 60 cubic yard reserve to avoid any delay in charging Dumpcretes. 3 Dumpcretes can be charged simultaneously on 3 separate driveways.

Three drive-over truck hoppers for two aggregates and sand. Emergency stocks of aggregates and sand for front end loading to truck hoppers.

Pre-mix paving is daily gaining greater preference in airfield and highway construction. It reduces congestion at the paving site by eliminating pavers and water trucks and provides centralized control over concrete quality. NOBLE manufacturers complete batching and mixing plants for every size job . . . from single 3 cubic yard mixer plants to the high production multiple batcher unit with three 10 cubic yard mixers shown below. All NOBLE central-mix plants feature the factory sub-assembly, extreme portability and rapid erection typical of NOBLE transit-mix and dry-batch plants that have produced quality concrete at lowest cost per yard for over 30 years.



NOBLE COMPANY
1860-7TH ST., OAKLAND, CALIF. • TEMPLEBAR 2-5785
Branches:
CLEVELAND 13, OHIO—75 Public Square, TOwer 1-0240
SEATTLE 9, WASHINGTON—518 First Ave., North, ATwater 4-4878
EL SEGUNDO (LOS ANGELES), CALIF.—218 Richmond St., ORegon 8-6473 / EAstgate 2-4518
NEW YORK 17, N. Y.—52 Vanderbilt Ave., ORegon 9-6475
Export Distributor, Frazar International Corp., San Francisco

DISTRIBUTORS: BIRMINGHAM, ALA., Equipment Service Co., Inc. • PHOENIX, ARIZ., Western Machinery Co. • LOS ANGELES, CALIF., Smith-Booth-Usher Co. • DENVER, COLO., Western Machinery Co. • CHICAGO, ILL., Arrow Contractors Equipment Co. • INDIANAPOLIS, IND., Flesch-Miller Tractor Co. • DANVILLE, KY., Central Supply & Equip. Co., Inc. • BOSTON, MASS., Hodge & Matthais Co. • DETROIT, MICH., R. G. Moeller Co. • ST. PAUL, MINN., Borchert-Ingersoll, Inc. • BILLINGS, MONT., Seitz Machinery Co. • ST. LOUIS, MO., George F. Smith Co. • OMAHA & NORTH PLATTE, NEB., Construction Service Equipment Co. • ALBUQUERQUE, N. MEX., Contractors Equipment & Supply Co. • SYRACUSE, N. Y., L. B. Smith, Inc. • STATESVILLE, N. C., Interstate Equipment Co., Inc. • CINCINNATI, OHIO, The Bode-Finn Co. • CLEVELAND, OHIO, Wepco Equipment Co. • PORTLAND, ORE., Clyde Equipment Co. • HARRISBURG, PA., Highway Equipment & Supply Co. • PITTSBURGH, PA., Equipment & Supplies, Inc. • NASHVILLE, TENN., Peterson Machinery Co. • DALLAS, TEX., Lumby Machinery Co. • EL PASO, TEX., Border Machinery Co. • HOUSTON, TEX., Pearce Equipment Co. • SAN ANTONIO, TEX., Girard Machinery & Supply Co. • SALT LAKE CITY, UTAH, Arnold Machinery Co. • SEATTLE, WASH., Clyde Equipment Co. • SPOKANE, WASH., Western Machinery Co. • CASPER, WYO., Studer Tractor & Equipment Co., Inc. • CALGARY, ALB., Precision Machinery & Equipment, Ltd. • VANCOUVER, B. C., National Machinery Co., Ltd. • TORONTO, ONT., Crothers Mfg., Ltd. • WINNIPEG, MANITOBA, Prairie Equipment & Radiators Co., Ltd. • MONTREAL, QUE., Laurentide Equipment Co., Ltd.

. . . for more details circle 335 on enclosed return postal card

New Products

Continued from page 135

Hale Diaphragm Pump

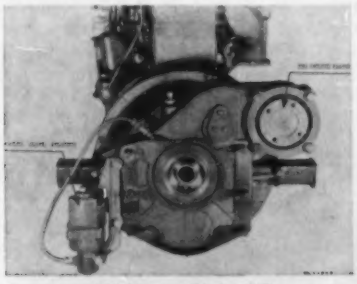
in., 2 in., 3 in., and 4 in. models, is designed for the handling of high-solid-content water and for positive control of seepage. Compactly built and mounted on wheels, they are also said to be easy to handle in cramped quarters, fast to set up and operate. Other features are; Power option—available with gasoline engine, electric motor drive, for users' own available power; and simplified design which allows fast easy repairs.

Hale Fire Pump Company, Conshohocken, Pa.

For more details circle 124 on Enclosed Return Postal Card.

Power Take-Off

A full torque flywheel power take-off for heavy-duty International trucks has been announced by the motor truck division of International Harvester Company. The new "PTO" is designed to meet the needs of ready-mix and other hauling operations where high torque and horsepower outputs are required.



IH Power Take-Off

Now available on V-8 and six cylinder engine-powered chassis in the 21,000 to 41,000 lb. gross vehicle weight range, there is no additional space required between flywheel and transmission for this unit.

The helical gear-driven power take off provides a constant 88 per cent output of engine speed through the output shaft. It is capable of a sustained 75-horsepower output.

International Harvester Company, 180 N. Michigan, Chicago 1, Ill.

For more details circle 125 on Enclosed Return Postal Card.

Davis HydraXcavator

Excavating Machine

A new Model BR-5 HydraXcavator has been announced by Davis Engineering, Inc. The unit is said to incorporate many features of previous models in this line.

Chasis is of extra heavy construction in this unit, and driver is positioned over left front wheel housing. Short wheel base and full swing on the upper mechanism gives the machine great versatility. A Continental F-266 engine provides a road speed of 40 mph. Standard attachment on the BR-5 is the "Hydrascope"; this attachment offers the ideal tool for maintenance of embankments and waterways. Its boom has a reach of over 20 ft. from center of swing with a telescoping action of 7 ft. The end attachment may be rotated 90 deg. either side of center.

Davis Engineering, Inc., P.O. Box 127, Dowagiac, Mich.

For more details circle 126 on Enclosed Return Postal Card.

Heavy Duty Trucks

Two new conventional model trucks with V-8 engines are designed for operation in heavy service on-road and off and are available from the Diamond T. Motor Truck Company. The engines are of wet-sleeve construction, said to operate with peak efficiency.

The company's new "R" cab is used on these V-8 models which are designated 738R and 838R. The cab is ruggedly constructed and combines improved ventilation and visibility for the driver, the manufacturer states. Gross combination weight ratings are as high as 78,000 lb., and gross vehicle weight ratings are up to 60,000 lb. Both units are also available as 6-wheel models.

New "T" V-8 Models

Diamond T. Motor Truck Company, 4401 W. 26th St., Chicago 23, Ill.

For more details circle 127 on Enclosed Return Postal Card.

Flasher Light

A new high intensity transistorized flasher light that can be seen for more than a mile in 2 directions is announced by R. D. Fageol Co.

Known as the Transi-Flasher Model Hd-2T, the unit is said to produce over 70 brilliant flashes per minute, front and rear, through two 4-in. optical plastic fresnel lenses. The latter held in a durable metal head, afford peak diffusion, the maker states. Electronic circuit of the flasher which includes 2 transistors, 1 capacitator and 4 resistors, is said to require no field service or adjustment. A standard 8 cell battery used in the unit is reported as having a minimum of 60 full days continuous working life.

Fageol Hd-2T Transi-Flasher

R. D. Fageol Co., Kent, Ohio

For more details circle 128 on Enclosed Return Postal Card.

Circuit Checker

Kent-Moore Org., Inc. announced a compact and inexpensive device for detecting short circuits. Called J 8681 "Circuit-Check," the unit attaches to the fuse sockets in a grounded circuit, providing intermittent, safe power through the circuit.

Pulsing current indicated a complete circuit; the sensitive meter detector then oscillates when placed over the wire when power surges through. When the meter detector moves past the ground, it oscillates to a much smaller degree or ceases; indicating the location of the ground.

Kenti-Moore Organization, Inc., 28635 Mound Rd., Warren, Mich.

For more details circle 129 on Enclosed Return Postal Card.

Brunner & Lay

AIR TOOL ACCESSORIES

The tools you know and trust. Request complete line bulletin #759. Brunner & Lay, Inc., 9300 King St., Franklin Park, Ill. Est. 1882. Plants & conversion shops: Albuquerque, Asheville, Birmingham, Dallas, Denver, Dorchester (Boston), Long Island City, Los Angeles, Philadelphia, Portland, Sacramento, Seattle, Yardley (Spokane), Lachine, P.Q., Vancouver, B.C.

Brunner & Lay Products

CARBIDE ROK-BITS, INTRASET STEEL, DRILL RODS, COUPLINGS, ADAPTERS & SECTIONAL STEEL. AIR TOOL ACCESSORIES—MOIL POINTS, CLAY SPADES, ASPHALT CUTTERS.

. . . for more details circle 288 on enclosed return postal card

Set up to 200 Seedlings a Day By Yourself with a DANUSER DIGGER

Precision Engineered to Last a Lifetime!

DIG HOLES SITTING DOWN! Your DANUSER DIGGER can pay for itself in saved time and labor because it makes hard jobs easy, requires little maintenance, and lasts a lifetime. It is precision engineered, from the best materials, to stand the strain of moving big amounts of earth. That means it is perfect for heavy jobs like setting seedlings. The 24" auger illustrated is too big for less rugged diggers, yet the DANUSER DIGGER handles it easily. Other auger sizes, from 4" to 18", available for fencing, foundations, many other uses. Write today for literature describing application to your tractor.

DANUSER MACHINE CO.

557-45 East 3rd Street • Fulton, Missouri

"Contributing to Farm Mechanization"

. . . for more details circle 298 on enclosed return postal card

New Products

Belt Adjusting Device

A conveyor belt tension and alignment adjusting device which utilizes hydraulic pressure has been developed by Western Conveyor Company.

This new hydraulic adjuster is the Schrock "Hydraligner" which provides variable positioning of a conveyor pulley for proper belt tension and alignment. It consists of a hydraulic cylinder attached to a bearing housing. The piston is moved by pressure applied with an ordinary grease gun, and it holds its position with pressure maintained by positive-action piston seals.

"Hydraligner" Adjusting Device

The unit is available in shaft sizes from $1\frac{15}{16}$ through $3\frac{7}{16}$ in. Standard adjustment stroke lengths are 14 in., 18 in., 24 in., and 36 in. Hydraligners for shaft sizes and stroke lengths other than above will be added as the demand warrants.

Western Conveyor Company, P. O. Box 357, Boise, Idaho

For more details circle 130 on Enclosed Return Postal Card.

4-Wheel Drive Tractor

A low priced, four-wheel drive tractor designed for light construction work, has been designated the W4G062 by Detroit Tractor Limited.

The unit is available in four hydraulically operated and ready equipped models; bulldozer, grader clam, roll bucket and loader. Controlled differential steering gives a turning radius of 12 in. in a 6 ft. curb to curb circle. Other features include double acting hydraulic cylinder with float position valve and a new design that is said to allow easy removal of clutch or transmission. The dozer includes scarifier rack and wing plates which can be easily detached. The blade is simple to remove for replacement with other attachments, the manufacturer states.

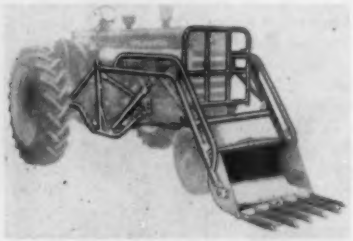
Detroit 4-Wheel Drive Tractor

Detroit Tractor Limited, Muskegon, Mich.

For more details circle 131 on Enclosed Return Postal Card.

Loader Attachment

Introduction of an all-new, heavy duty loader for Farmall and John Deere tractors, is announced by Freeman Loader Corporation. Known as Model M-620, the new loader fits 10 Farmall Models, H through 560, and 12 models of John Deere, A through 730. The unit is said to feature ease



Freeman Loader Attachment

of installation and removal. The 9-cu. ft. bucket, combined with gravel plate, is 40 in. wide and has bolted-in $1\frac{1}{8}$ in. axle steel teeth.

Freeman Loader Corporation, Blair Pike Rd., Peru, Ind.

For more details circle 132 on Enclosed Return Postal Card.

Front Driving Axles

Elenco Products, Inc., has announced the addition of two new axles to their line of front driving axles for converting Ford tractors to four wheel drive.

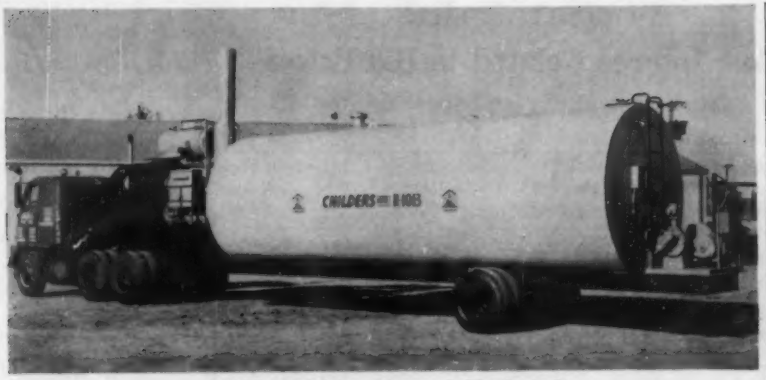
The tow axles include a heavy duty axle for Ford 1800 series industrial tractors and a high clearance axle for the 600 and 800 series Ford tractor. The manufacturer reports that by installing the front wheel drive, the tractor can do a larger variety of jobs, as

Elenco Front Driving Axles

well as have increased load and pulling capacity with less wear and tear in the tractor itself. Also, many types of special-mounted equipment such as loaders, backhoe, forklift, mower, etc., can be used to greater advantage.

Elenco Products, Inc., 149 S. River St., Aurora, Ill.

For more details circle 133 on Enclosed Return Postal Card.



Childers Trailer Mounted Tank and Heater

Asphalt Storage Tank

Childers new trailer-mounted asphalt storage tank and heater combination has been designed to provide portable, efficient asphalt storage heating generally found only in a permanent plant, states the maker, Childers Manufacturing Company, Inc.

The desired size heater and insulated tank are mounted on a gooseneck trailer; the unit is completely plumbed and wired ready for immediate operation. An electrical generating plant can be installed on the trailer next to the heater if power is not available at a jobsite. Standard equipment includes 10 stud dual wheels, 10 ply tires, 5th wheel and plate or pin and built-in tank for heater fuel. All tanks are insulated with 2 in. Fiberglas.

Childers Manufacturing Company, Inc., P. O. Box 618 Sta. B., Albuquerque, N. M.

For more details circle 134 on Enclosed Return Postal Card.

2 Cu. Yd. Loader

A 4-wheel drive loader with 10,000 lb. lifting capacity features a dumping level of 10 ft. 6 in. and is available from Lull Engineering Company.

Because of design and weight distribution, the loader does not require ballast whether digging or carrying a full bucket; it can also back up a 35 deg. incline with a full bucket. Operator seat is placed high and towards the rear of the unit for maximum safety. Although having a long wheelbase, the loader has a turning radius of only 8 ft. 8 in.

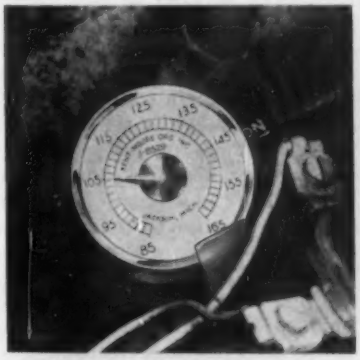
Lull Engineering Company, 3045 Highway 13, St. Paul 11, Minn.

For more details circle 135 on Enclosed Return Postal Card.

Lull Loader Filling 10-ft. High Truck

Regulator Temp Gauge

A tool designed to aid in setting voltage regulators with regard to the temperature of the regulator itself has been developed by Kent-Moore Organization, Inc. Settings made without accurate reference to temperature can result in over-charging; this thermometer magnetically sticks to the regulator to provide instantaneous temperature data.



Kent-Moore Voltage Regulator Temp Gauge

Kent-Moore Organization, Inc., 28635 Mound Rd., Warren, Mich.

For more details circle 136 on Enclosed Return Postal Card.

Welding Kit

The Arcair "Weld Help Kit" is a sampling package of welding carbon plate, rod and paste. The kit contains eight diameters of carbon rods, three thickness of carbon plate, a can of carbon paste, a can of "Protex" surface protection compound, and a manual showing some of the applications to produce better welding.

Arcair Company, P. O. Box 431, Lancaster, Ohio.

For more details circle 137 on Enclosed Return Postal Card.

Continued on page 159

for guaranteed aggregate specifications

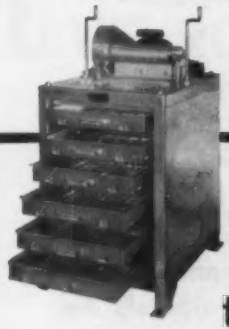


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FIGURE 4

Recent Cost Indices Related to Bid Prices

(Bureau of Public Roads figures for Federal-Aid Work)

	Material	Owning and Operating Equipment	New Equipment	Wage Rates	Actual Labor Costs	Highway Construction Bid Prices*
4th quarter 1958	219.5	215.4	242.7	397.5	225.6	141.6
1st quarter 1959	219.9	218.9	247.5	381.6	214.6	140.8
2nd quarter 1959	219.7	219.9	248.3	396.0	220.4	137.1
3rd quarter 1959	219.5	221.7	248.6	404.6	237.0	137.3

Note: on 1946 base of 100

1960 OUTLOOK

Continued from page 125

tomatically on to the consumer, this question would be easier to answer. But with the competition situation what it is, no one wants to read the mind of the contractor —especially the new contractors whose tendency it will be to bid lower than they probably can afford, just to keep their hand in.

Contractor Costs in 1959

Meanwhile, what happened to contractor costs last year?

Briefly, the cost of materials hardly changed; the cost of new equipment rose a bit; and the cost of labor vacillated up and down, ending the period 5½ percent higher than costs for 1958.

Range of Contract Sizes

Important to all contractors, new or old, is the prospect for contracts of a size they can handle. The dollar volume of work available may be meaningless if the projects come out in sizes beyond the ability of their organization to handle.

The most recent analysis of federal-aid contracts by the BPR reveals that there are still plenty of small jobs in the work flow. This is in spite of the temptation of state highway departments to seek the economies possible through large production assignments. Officials feel that greater economies are possible through increased competition smaller offerings create.

Also, the pressure for small jobs is still on the Bureau from several influential sources. Congress and the Small Business Administration, particularly, insist on a sufficient number of small contracts. The chances are that the proportion of small contracts in the awarding schedules will be about as high as in 1959.

How Fast the Pace?

Tied up in the press of day-by-day business, roadbuilders seldom have time to study complicated reports of long-range progress on the ambitious National Highway Program. For the benefit of those who must read on the run, here is how the multi-billion program is rolling and how much has been accom-

FIGURE 5

Many Small Jobs in the F.A. Program

A wide spread in the size of contract offerings continued to be a characteristic of the federal-aid highway program during 1959. An analysis of 4,022 contracts awarded during the first six months indicates the following division by sizes.

Size of Contract	Number of Contracts	Percent of Total Contracts	Total Amount of Low Bids	Percentage of Total Value
Under $25,000	630	15.66	8,277,600	0.59
$25,000 - $50,000	584	14.52	21,537,800	1.53
$50,000 - $100,000	748	18.59	54,063,800	3.83
$100,000 - $250,000	893	22.20	145,959,800	10.35
$250,000 - $500,000	453	11.26	161,407,000	11.44
$500,000 - $1 million	331	8.23	232,450,500	16.48
$1 million - $2 million	251	6.24	353,148,000	25.04
$2 million - $3 million	75	1.87	174,611,300	12.38
$3 million - $4 million	27	0.68	93,432,700	6.63
$4 million - $5 million	16	0.40	73,088,000	5.18
$5 million - $10 million	14	0.35	92,307,200	6.55
Totals	4,022		1,410,284,400	

plished in the three years since Congress started the wheels rolling.

Contractors are moving earth and pouring pavement at an unprecedented pace. According to Commissioner Ellis Armstrong of the U. S. Bureau of Public Roads, roadbuilders in recent weeks were moving 20,000,000 cu. yd. of earth per day. Over 350,000 machines were at work on road jobs around the nation—shovels, scrapers, trucks, pavers and all the other specialized units.

Highway departments have largely erased the threat of the engineering shortage. Using modern techniques for location and design, they have greatly accelerated their output of plans for new projects and an estimated 25,000 miles of the 41,000-mile Interstate System have been tied down to final location.

Procedures for holding hearings have been worked out in most states so that a disgruntled few property owners can no longer hold up the routing of a proposed project indefinitely. Right-of-way agents have become more proficient in their work, and aided by streamlined laws, are acquiring thousands of acres of land each week.

Here are the latest statistics available from the BPR to indicate what has thus far been accomplished:

$2.1 billion worth of work has been completed on the Interstate System since July 1, 1956. Another $2.9 billion worth is currently under construction. Together, these figures stand for construction on 10,023 project-miles of roadway and 8,966 bridges.

$4.9 billion worth of work has been completed on the ABC Systems during the same period, with another $2.2 billion worth under way.

Behind the construction stage, engineers have received BPR authorization to start preliminary engineering and acquisition of right-of-way on another $2.2 billion of work on the Interstate net.

During the month of November, alone, contractors finished 172 Interstate projects, representing work on 386 project-miles and 427 bridges lower, worth $261 million.

Job Safety

Seat Belts for Operators

"We have installed seat-belts on the DW-20 haul units we are employing on this project with very satisfactory and gratifying results. Several incidents involving extensive property damage which have taken place, have indicated beyond a doubt the value of these belts.

"One incident that occurred—a loaded machine colliding with an unloaded machine going in opposite directions, resulted in some $45,000 property damage and *neither operator was so much as bruised.*

"Another incident that occurred, involved two more of these machines traveling one behind the other. The one ahead made an unexpected stop and the one behind collided with it, literally climbing upon it, also resulting in extensive property damage, and again *neither operator was injured.*

"The third incident took place when a loaded machine took to the 'escape' ramp and collided with a 10-wheel dump truck. The truck driver suffered *minor* bruises, but the DW20 operator suffered *no injury of any kind.*

"These belts are of a quick release type fastener. Each and every one of the operators involved in these incidents have stated that the use of these belts had undoubtedly saved their lives."

—Courtesy of
Guy F. Atkinson Company Safety Bulletin, and
Safety News Letter of the National Safety Council Construction Section

Worker's Lost Fingers

The safety of a worker's fingers—industry's best production tools—is the subject of a new pamphlet published by the National Safety Council. Entitled, "A Simple Do-It-Yourself Project," it deals in a humorous pictorial manner with do's and don'ts of avoiding loss of fingers on the job. Single copy free on request from the National Safety Council, 425 N. Michigan Ave., Chicago 11, Ill.

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Mixing water into the subbase material before spreading and compaction is an efficient and effective means securing uniformity.

Segregation and nonuniform density are difficult to avoid when the maximum size of the subbase material is greater than about 1½ in.

SUBBASE FOR CONCRETE

Continued from page 68

and not mixed into the subbase, it will usually penetrate only about ½ in. even in fairly permeable materials. In order to get uniform density, the additional water must be thoroughly mixed into the material until it has a uniform moisture content.

When water is added to the subbase material after it has been spread on the grade, the mixing is effectively accomplished by the use of motor graders or multiple pass type mixers.

The mixing of subbase material and water in pugmills is becoming more widespread. The material is then placed evenly on the grade by aggregate spreaders and compacted. The slight additional cost of this method is often offset by the ease in placing and compacting the subbase.

The mixing is also beneficial in reducing segregation of the subbase material. Segregation results in variations in the density, moisture content and permeability of the subbase, which may in turn lead to variations in the density and moisture content of the subgrade soil. The careful handling and mixing of subbase material during construction, so as to avoid nonuniform gradation, pays off in improved pavement performance.

The method which will produce the most effective results in compacting a relatively thin granular subbase to a uniform high density depends mainly on the type of material. It is often worked out by experimentation in the initial phase of the work, during which the type and weight of equipment, the number of passes and the subbase moisture content are varied. This frequently leads to the use of a combination of two or more types of equipment. The trend in subbase compaction is toward the increased use of vibration and heavier pneumatic compactors.

When vibratory compaction is used the best results are achieved if the material contains enough moisture so that the vibration flushes a film of water to the surface. After only a few passes of vibratory rollers the density of granular materials is usually increased to relatively great depths. In thin layers of granular materials on soft subgrades and in cohesionless material such as clean sand, which tend to shove under rollers, pan type vibrators often produce the best results and in some cases may be the only means of obtaining the required density. Initial compaction by this equipment may facilitate the operation of rollers on the subbase for additional compaction.

In many cases vibration has proven effective when

Operating batch trucks on the finished subbase causes rutting, segregation and nonuniform density.

It is important to thoroughly compact the subbase next to the forms during final rolling.

it was difficult or impossible to obtain the required density by rolling. However there have been cases in which vibration has not worked as well as pneumatic rollers.

Smooth-wheel rollers are still extensively used for compacting granular subbases. When the weight is in the range of 10 to 12 tons they are reasonably effective in securing uniform density, if the subbase is well-graded from coarse to fine size, with enough fines to pack out and if the maximum size of the material is not more than about 1.5 in. If the maximum size is larger, the steel wheels tend to ride on the high spots, bridging over low areas. This results in nonuniform density.

Multiple-wheel rubber-tire rollers, either tractor drawn or self-propelled, are effective in compacting most granular subbases to uniformly high densities. In addition to providing the pressure needed to densify the subbase, they have a kneading action which knits the granular material into a dense mass. Heavy rubber-tire units weighing 30 tons or more are in wide use. As pointed out earlier, they are also particularly useful in locating soft spots.

Fine Grading. After the forms have been set to the correct alignment and elevation, and have been thoroughly tamped, excess subbase material is removed from between the forms. When the full width of the subbase is left slightly after initial compaction, the fine-grading is a cutting operation, and disturbance of the subbase surface and resulting variation in density, gradation and permeability are reduced. However, when the subbase is left high in the middle and low at the sides, variation across the width of the roadway is likely to occur since the edges are brought up to grade by filling in with loose material while the initial density is retained or increased in the center. This is especially true when the subbase next to the forms is neglected during final compaction.

On lane-at-a-time construction, motor graders can be adapted for fine-grading by use of a special cutting blade, with metal rollers or slides which ride on the two side forms. One of the simplest fine-graders for two-lane construction is a steel scraping blade with flanged wheels riding on the side forms. It is pulled by tractors or rollers working inside the forms. This equipment must be of substantial weight for cutting a properly compacted subbase. It performs satisfactorily on sandy material. The blade should be set high enough above the finished grade to permit final subbase compaction.

Mechanical fine-graders with oscilating, revolving

or vibrating cutting blades and conveyor belts for removing excess subbase material are generally used when the subbase is gravel or crushed stone. The excess material is deposited either into trucks or in a windrow outside the forms. The windrow should be spread and compacted before the shoulder material is placed so as to avoid future maintenance problems.

Difficulty in fine-grading increases as the maximum size of the subbase material increases. If the maximum size is more than about 1.5 in. it is very difficult to avoid segregation and obtain uniform density. Large stones in pit-run gravel should be screened out.

Realignment of forms which have settled during wet weather prevents variations in subbase thickness due to the removal of excessive amounts of subbase material during fine-grading.

Final Compaction. The surface of the subbase is usually loosened and some loss of moisture occurs during fine-grading operations. Because of this, sprinkling and recompacting the top layer after fine-grading are required to restore uniform density to the full depth of the subbase. The entire surface should be uniformly sprinkled since if the moisture content is not uniform subsequent rolling will produce nonuniform densities. Because the slab edge is a critical location for pavement stress and deflection and subgrade pressure, particular care should be taken to restore uniform density along the forms.

For the recompaction of the relatively thin surface layer which has been disturbed by fine-grading, pan vibrators, pneumatic and 5- to 10-ton steel-wheel rollers have proven satisfactory. Where steel-wheel rollers are used the material should have a gradation such that it will pack out to a hard, dense surface.

Garden-type rollers attached to the fine-grader are not adequate for proper final subbase compaction. This method does not provide for additional rolling where it is necessary to restore uniformity to areas of variable density.

When the subbase has been completed all traffic should be kept off. The operation of the paver and batch trucks between the forms destroys the uniformity of the subbase. The batch trucks cause rutting and segregation; particularly at turn-around locations and where the forms are removed for their entrance and exit. Construction traffic produces higher densities in the center of the roadway than the final compaction equipment can achieve along the edges. This uneven density across the width of the roadway sometimes results in serious pavement defects, such as longitudinal cracking, due to differential support. Another serious disadvantage is that in wet weather the batch trucks track mud onto the completed subbase.

Uniformity of support is a critical factor in the construction of smooth pavement. The quality of subgrade and subbase construction becomes increasingly apparent each year that the pavement is in service. Many years later those responsible can look with pride on the results of the efforts expended in providing a uniform pavement support.

Variable Height Pier Developed by Army Engineers

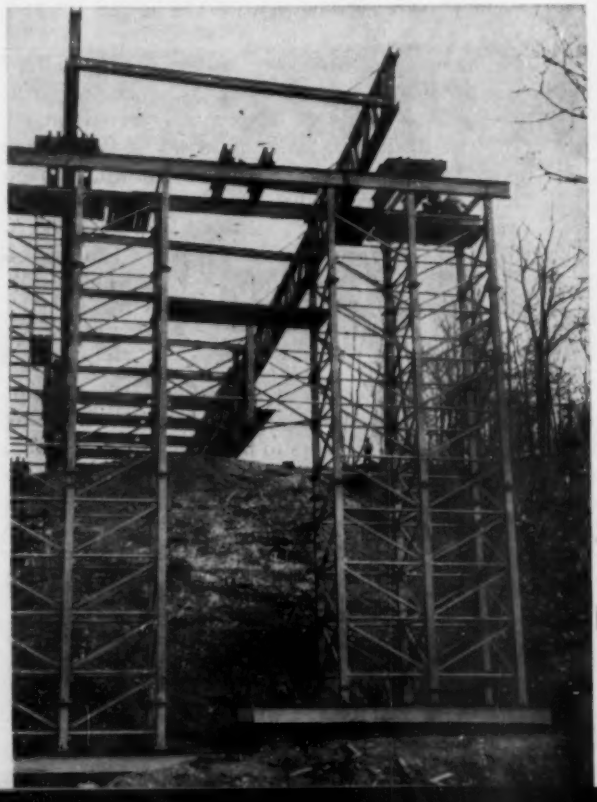
A variable height pier set for use in speeding the erection of tactical and line of communication bridges, and to reinforce civilian bridges for military loads, has been developed by the U.S. Army Engineer Research and Development Laboratories, Fort Belvoir, Virginia.

Designed for a maximum height of 100 ft., the pier can support 150-ft. span triple truss tactical bridges with a 100-ton eccentric load totaling 275 tons. It can be erected under varied site conditions to the desired height.

The pier consists essentially of columns of various lengths, bracing, and top and bottom grillage. Much of the bracing is made from pipe, and other parts are of standard structural rolled steel shapes. All connections are bolted.

The type of construction varies with the height and width of the pier. The heaviest number is a P-10 joist which weighs 1,836 lb. The upper grillage systems can be adjusted to provide small increments in pier heights not possible with the column lengths alone. There are 34 different components including hardware and derrick parts.

The Army's variable height pier for bridge support. Placement of the pier above shows the unit's adaptability to uneven terrain.



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Bituminous features appear
Between pages 148 through 157

Production Analysis Of A Hot-Mix Plant

A stop-watch study can spot causes of delays or slow-downs and pinpoint plant bottlenecks

By R. L. Peurifoy
Contributing Editor to Roads and Streets

Should a hot-mix asphaltic-concrete plant produce 60, 80, or 100 tons of mixed material per hour? Actually a 4,000-lb. batch plant has produced quantities within these limits, and probably outside them also.

While it is desirable to know the average production rate for a given plant operating under certain conditions, considerably more valuable information may be obtained by making a study of the factors which determine the production rate. The purpose of this article is to illustrate a method which was used in making such a study, which covered the operation of a mixer and dryer for a total period of 51 hours.

The plant included a 4,000-lb. batch-type mixer, which was operated to produce a 3,000-lb. batch.

The dryer was fired with natural gas.

The quantity of bitumen was controlled by an automatic weighing and charging device, using the Fluidometer System.

The bitumen was a 70-85 penetration asphalt cement.

The moisture content of the aggregate varied from 5 to 7 percent, averaging about 6 percent.

The aggregate was heated to a temperature of 360 to 400 degrees F, and the bitumen to 290 to 300 degrees F.

The average temperature of the mix when it left the plant was about 300 degrees F.

Table 1 gives the specified gradation for the aggregate, while Table 2 gives the quantity of each size aggregate and asphalt required for a 3,000-lb. batch.

Table 3 gives the time for the several cycle elements for the mixer, when the mixer was operating with no lost time owning to delays. The cycle included the time for mixing, discharging and aggregate charging lag. The last element was the time lag between the closing of the discharge gate and the operation of the aggregate charging lever. This cycle time, amounting to 0.89 minute, was considered to represent operation of the mixer under ideal conditions.

For the purpose of the study, delays in the op-

eration of the plant were classified as major and minor. Major delays were any individual time losses of 15 minutes or more in duration, while minor delays were any individual time losses of less than 15 minutes in duration.

The Total Time is defined as the entire time during which the study was conducted, and included the net productive time plus all delays regardless of cause or duration. For example, if a shift was 9 hours per day, the entire 9 hours were considered to be total time for that day. For this study the total time of the mixer was 51 hours.

The Net Working Time is defined as the total time less the time resulting from all major delays. For this study the net working time of the mixer was 34.8 hours.

The Net Productive Time is defined as the time during which the plant was actually operating, with all time lost as a result of delays excluded.

Table 4 gives the distribution of time for the mixer, including total time, net working time, and net productive time for the period of the study. A single rain caused a delay of 9 hours. Since this was a delay over which the contractor had no control, it should be disregarded when analyzing the causes of delays as a step toward reducing the time lost as a result of delays.

Table 5 lists the causes and extent of the major delays for the mixer. While delays No. 1, 4, and 5 may not be subject to control by the contractor, the other delays are for causes over which the contractor may exercise some control. For example, the delays owing to the shortage of trucks could have been eliminated by providing an additional truck. However, in order to justify the use of an additional truck, the value of the increased production resulting from the elimination of the delays must exceed the total cost of the additional truck, driver, and any other costs chargeable to the truck. The causes of the other delays should be examined to determine if it is financially advisable to undertake to reduce or eliminate the delays.

Table 6 lists the causes and extent of the minor delays, those for which the individual time losses were less than 15 minutes. Again the shortage of

Table 1. Gradation of Aggregate

Sieves with Square Openings

Coarse aggregate		Fine aggregate	
Sieve size, inch	Percent passing	Sieve size, inch	Percent passing
1	100	No. 4	100
¾	96	No. 6	98
½	80	No. 8	94
⅜	52	No. 16	64
No. 4	6	No. 30	38
No. 6	2	No. 50	14
		No. 100	5
		No. 200	2

Table 2. Specified Batch Proportions

	Percent	Weight, lb
Passing 1½ in., retained on ⅝ in. sieve	15.0	450
Passing ⅝ in., retained on 0.16 in. sieve	41.0	1,230
Passing 0.16 in. sieve	38.5	1,155
Asphalt	5.5	165
Total per batch	100.0	3,000

Table 3. Time for Mixer Cycle Elements

Operation	Cumulative time, min.
Begin charging aggregate	0.00
End charging aggregate	0.13
Begin weighing coarse aggregate	0.14
End weighing coarse aggregate	0.20
Begin weighing fine aggregate	0.21
Begin charging asphalt	0.23
End weighing fine aggregate	0.34
Begin weighing sand	0.35
End charging asphalt	0.43
Begin weighing asphalt	0.54
End weighing asphalt	0.66
Begin discharge of mix	0.77
End discharge of mix	0.86
Begin charging aggregate	0.89

Table 4. Time Distribution for Mixer

Item	Number of delays	Total time, hr	Percent of total time
Total time		51.0	100.0
Major delay because of weather	1	— 9.0	— 17.7
Other major delays	15	— 7.2	— 14.1
Net working time		34.8	68.2
Minor delays	610	— 6.4	— 12.5
Net productive time		28.4	55.7
Number of batches produced, 1,948			
Number of tons produced, 2,922			

Table 5. Major Delay Causes for Mixer

Cause of delay	No. of delays	Total delay time, hr	Percent of total time
1. Rain	1	9.0	17.7
2. Shortage of trucks	5	2.7	5.3
3. Late start by trucks	3	1.4	2.7
4. Paving intersections	2	1.2	2.3
5. Change in mix design due to aggregate	2	1.1	2.2
6. Down time at paver	1	0.5	1.0
7. Shortage of dried aggregate	2	0.3	0.6
Total	16	16.2	31.8

Table 6. Minor Delay Causes for Mixer

Cause of delay	No. of delays	Total delay time, hr	Percent of net working time
1. Shortage of trucks	35	3.3	9.5
2. Truck delays	63	0.6	1.7
3. Paving intersections	2	0.2	0.6
4. Shortage of dried aggregate	116	1.0	2.8
5. Adjust cold feed	67	0.3	0.9
6. Adjust burners	38	0.2	0.6
7. Excess discharge	146	0.1	0.3
8. Aggregate gate stuck	4	0.2	0.6
9. Personal	16	0.2	0.6
10. All other	123	0.3	0.9
Total	610	6.4	18.5

Table 7. Time Distribution for Dryer

Item	Number of delays	Total time, hr	Percent of total time
Total time		54.0	100.0
Major delay because of weather	1	— 9.0	— 17.7
Early firing of the dryer (1)	6	— 3.0	— 5.1
Other major delays	6	— 4.3	— 8.4
Net working time		37.7	68.8
Minor delays	3	— 0.4	— 0.7
Net productive time		37.3	68.1
Number of batches produced, 1,948			
Number of tons of dried aggregate produced, 2,863.7 (2)			

(1). The dryer was fired for 30 min. prior to starting the mixer operating each of 6 days, for a total time of 3 hours.
(2). From the total of 2,863.7 tons of dried aggregate produced by the dryer, 102.4 tons were returned to the stockpile. This included excess aggregate left in the bins at the end of the shifts plus the dried aggregate required to heat the bins and mixer prior to starting production. Thus the net production for use by the mixer was 2,761.3 tons.

Table 8. Production Rates for the Dryer
Based on Producing 2,761.3 Tons of Usable Aggregate

Condition	Time, hours	Production rates, tons per hour	
		Aggregate	Mix
Total time	54.0	51.2	54.2
Deduct delay due to weather	45.0	61.5	65.1
Deduct delay due to early firing of the dryer	42.0	65.8	69.7
For net working time	37.7	73.4	77.7
For net productive time	37.3	74.2	78.5

trucks was a major cause of the delays under this classification. It appears reasonable that a careful examination of the causes of delays would reveal that reductions could be effected.

While a reduction in the time lost because of delays is desirable, this subject must be considered in a practical manner—which to a contractor means that he can afford to spend money to reduce delays, only as long as the value of any increased production exceeds the cost of attaining the reduction.

Tables 7 and 8 give the distribution of time and production rate information for the dryer which processed aggregate for the mixing plant. It will be noted that the number of delays and the resulting time lost were less for the dryer than for the mixer. Table 8 gives the production rate of dried aggregate for each of the stated conditions. Also, the table gives the equivalent quantity of mixed product which could be produced for each production rate of dried aggregate.

This quantity is obtained by adding to the dried aggregate the amount of bitumen required to meet the specifications for the mix. It should be noted that if the output of the mixer were increased substantially by reducing delays, the dryer might not have sufficient capacity to produce the required amount of aggregate.

Thus the capacity of the dryer might limit the ultimate production rate of the plant.

Studies of the performance of construction equipment, such as the one described in this article, will enable a contractor to understand more clearly just what factors influence the production rates of his equipment. While information giving average production rates is highly desirable, such information will seldom enable one to pinpoint the reasons for the limiting production. More effective steps can be taken to eliminate or reduce delays after the reasons for the delays are determined. For many years the manu-

Continued on page 157

AAPT Meeting to Review Asphaltic Concrete Control

Field and laboratory control of asphaltic concrete and correlation of the two, will be the subject of a symposium at the forthcoming meeting of the Association of Asphalt Paving Technologists. The meeting is to be held at the Hotel Peabody, Memphis, Tennessee, January 25-27.

Moderator of the panel will be Charles F. Parker, Engineering Laboratory Service, Westbrook, Maine, with the following participants: Lloyd D. Ritter, contractor, West Monroe, La.; Paul D. Sonderegger, Western Laboratories, Inc., Lincoln, Nebr.; Vaughn Marker, The Asphalt Institute, Berkeley, Calif.; and Earl Althar, Ohio Department of Highways.

Other papers shaping up for the meeting according to AAPT's secretary-treasurer Ward K. Parr will cover: heating and drying of aggregates; properties of highway asphalts; filler in relationship to asphalt mixture qualities: quality control of asphaltic concrete at the AASHO test road; thixotropic characteristics of asphalt paving mixtures; effects of consistency of asphalt cements and types of mineral filler on compaction of asphalt concrete; composition analysis used to explore asphalt hardening reactions; factors influencing performance of paving asphalts; the effects of antioxidants, polymers, and methods of processing; study of welded wire reinforcement of bituminous concrete resurfaces; use of chlorinated solvents in the Abson recovery method; and basic principles of design and construction of seal coats and surface treatments.

Asphalt Institute Lists New Officers

Eugene M. Stone, president of the Empire Petroleum Co., Denver, Colo., is elected Chairman of the Board of The Asphalt Institute, succeeding Don L. Nielsen of the Union Oil Co. of California.

In other action at the Institute's recent annual membership meeting in Washington, D. C., the following officers were named as regional vice presidents:

William N. Ruppel, Atlantic Refining Co., Philadelphia; A. R. Curtis, Esso Standard Oil Co., New York; L. W. Walker, Leonard Refineries, Inc., Alma, Mich.; J. W. McCracken, Byerlite Corp., Cleveland; E. E. Scholer, Shell Oil Co., St. Louis; F. H. Brown, Mobil Oil Co., Kansas City, Mo.; Marshall O. Hardy, D-X Sunray Oil Co., Tulsa; A. T. Van Pelt, Berry Asphalt Co., Magnolia, Ark.; C. W. Turner, American Bitumuls and Asphalt Co., San Francisco and Charles P. Taylor, Wilshire Oil Co. of California, Los Angeles.

President J. E. Buchanan announced plans to sponsor an international conference on asphalt pavement structures in 1961, probably at some Midwestern university. The conference would be timed to make pertinent use of data compiled in two multi-million dollar American road tests and a recently concluded British road test.

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You can see the results of Etnyre's exclusive triple-lap coverage (spray from each nozzle overlapping *two* other sprays) in the unretouched photograph above. Road builders have learned that single-lap coverage is utterly unsatisfactory . . . double-lap coverage somewhat better . . but triple-lap coverage is the complete answer to hitting rough aggregate from all possible angles for complete coverage.

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Views And Comments

By H. G. Nevitt

The Most Important Development

If the average highway engineer were asked what he considered the most important among those technical developments which today appear possible, there would undoubtedly be many replies.

Actually, there are many needed advances in our knowledge of highway engineering, and we would have difficulty stating which appeared the most important.

We wonder how many would vote for the need for a road structure thickness formula—one which is reasonably rational, realistic and simple from the standpoint of available present laboratory testing and general engineering information.

A strong case can be made for the importance of this development. The arguments therefore should be of interest to our readers. We consequently wish to present the chain of logic to support this viewpoint as we see it.

We doubt that anyone will challenge the statement that the basic overall problem faced by highway engineers and administrators today is a shortage of money to do the job required. Highway improvements have increased at a fantastic rate, but they still are not sufficient to keep up with the need, nor does the future offer any encouragement in this respect. Certain cost factors in the construction of new or improved highways are more or less fixed, but others have been shown by experience to vary considerably with the design requirements. Among the latter are the expenditures for the road structure—that is, the surfacing and foundation courses. If these can be designed to just the proper thickness for their functions there are undoubtedly excellent opportunities for savings.

The biggest prospects for such savings lie in the field of flexible pavements. This type should naturally prove the most economical, since it utilizes the support of the underlying soil to the maximum extent possible. No additional strength is required to bridge over areas of poor contact, since the pavement adjusts itself to the foundation bearing conditions in the course of its construction and early use. However, our ability in this respect—namely to design the precisely correct pavement for the given load and support conditions—is limited by our lack of exact knowledge concerning the support characteristics of such a structure. We must to some extent guess at the proper total thickness and the optimum interrelationship between the thickness of the various pavement layers to give us the required load carrying ability. We recognize that there are a number of flexible pavement design techniques available, and that they give fairly good results in many cases; but we feel certain that design approaches displaying the accuracy obtained today in the field of bridges would permit much more economical cross sections, yet meet the indicated functional requirements.

Another corollary problem is that our present design methods are not too helpful from the standpoint of consistency. Part of this difficulty is inherent in the problem. The station to station variations which may appear in soil of the same general characteristics cannot be offset by construction changes. However, we can expect to get design criteria which reflect the particular needs for a section of practical length rather than average out in a general way the soil demands. This consistency in design is a rather difficult concept, but it is highly important—particularly where the design formulae in use have been more or less developed on the basis of experience and therefore necessarily reflect more or less generalized rather than specific conditions.

Since this matter of consistency in design has given difficulty, we will illustrate it by an example. Let us consider a state which adopted the CBR method soon after its inception. After several years of experience, modifications will have become clearly necessary to adapt the procedure to the state's particular conditions. This is because the method does not exactly evaluate the critical factors, so that some sections will have proven satisfactory, others with the same test criteria will have shown distress. The resulting modifications, perhaps supplemented by later changes, will provide designs which are satisfactory for the average conditions of that state. This is more or less the correct history, as evidenced by the fact that almost all the states using this approach have modified the technique, each generally with its own special version.

While the designs from the revised approach will have eliminated failures, this does not mean that the roads built are all consistent from the design standpoint. Parts of some projects could have used the thinner earlier sections where the soil conditions suited the original formula; however, it has eliminated failures and is therefore clearly to be preferred in choosing between the two.

A truly rational formula would avoid this problem.

Some engineers disagree with this consistency criticism, feeling that if a section is presently overdesigned the traffic will grow up to the needs. This is true only on projects consistently overdesigned throughout; on others, it is only true in theory. If we could observe all projects

until failure had progressed far enough to clearly define the weak sections, these alone could be strengthened and the design made consistent. In practice this cannot be done; action must be taken promptly when a relatively limited amount of failure appears, and since there is nothing in the design approach to distinguish those areas which are weak and will go if precautions are not taken, the whole project is strengthened, and the design inconsistency perpetuated.

What would be the benefits of the development of a completely rational and consistent thickness design?

We believe it would result in a general thinning down of the road cross-section over much of the terrain (though perhaps with some thickening on a few critical sections), along with a constant factor of safety relative to the traffic anticipated, and suitable for uniform thickening as the traffic load increased. This would in turn further increase the economic advantage presently shown almost universally by the flexible type when essentially equivalent designs are compared. There should then be an even greater use of asphalt surfacings, along with an extension of the total mileage which could be built from the funds available. This development would be particularly helpful to the intermediate traffic type of highway; and with the increasing development of this type, the pressure for the very costly arterial routes would diminish except for through or long-haul traffic.

We undoubtedly need the interstate system now under construction, along with some of the freeways and other heavy traffic primary routes planned or being built. At the same time, the funneling of traffic into such routes for relatively short movements, which is so common today due to the lack of a modern net of secondary highways in many localities, would diminish as suitable direct alternates to these heavy duty routes became available; consequently the high expenditures for structures, right of way, and other factors which make these heavy duty routes so costly would diminish.

We think it is critical that every highway engineer recognize the importance of a suitable thickness design. And it obviously is to the interest of those benefiting from the development of the flexible type to aid in this respect: they will not merely advance their own interests but they will likewise aid the cause of good roads. Because of its importance, we plan to devote future space to discussion of the principal factors involved in the development of a thickness formula. We do not intend to discuss the various methods used in detail, but we do feel that all highway engineers (not excepting those not directly concerned with design) can do much to help on this problem, and we would like to enlist their aid in this cause.

Editor's Note:

This review was intended by the author to precede the article, "Highway Loadings," published in November as the logical sequence in ideas being developed here. The reader may possibly wish to refer back to that article.

Suggestion on Proper Installation of Subdrains

The flow line of a subdrain should be below the water-bearing strata for most effective drainage. If this isn't possible, however, the line may be placed *in* the strata. It will not provide complete drainage, but it will lower the natural water table, if this is all that is required.

The underdrain pipe should be laid on a stable base to prevent settlement. If the line is laid below the water bearing strata on an impervious layer, it will generally be stable. Otherwise, it may be necessary to stablize the bottom of the trench by placing a minimum of granular material under the pipe for bearing.

Assembly of a subdrainage system is usually started at the downstream end to allow ground water to drain out of the trench during construction. With Armco Hel-Cor perforated pipe, the perforations should be located at the lower quarter points (see illustration). This lowers the water table to the bottom of the pipe instead of the top and reduces infiltration of silt and filter material as well. The unperforated section in the bottom will handle the normal flow of intercepted water.

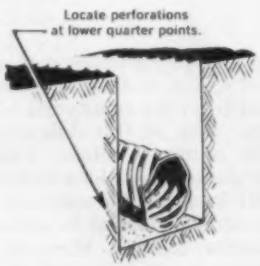
Connecting bands for this type of pipe are made in two pieces and corrugated to fit the pipe. Joints are made by placing one-half of the band under the two sections of pipe so that the corrugations match. Then place the top half of the band and tighten the bolts.

Each section of the pipe should be rotated to place the perforations in the bottom quarters. This may result in a small gap between adjoining sections, but the coupling band will effectively seal it.

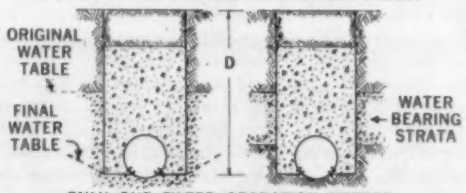
Latex-Modified Mortar for Deck Repairs

Use of a synthetic latex emulsion admixture with portland cement mortar as a thin patching mixture was described in a paper scheduled for the Highway Research Board's 39th annual meeting this month in Washington, D.C. The authors, S. M. Cardone and Myron Brown of the Michigan state highway department, and Albert A. Hill of Dow Chemical Company, presented data on the improvement over regular p.c. mortar for this mixture for bridge deck repairs made at Sheboygan, Mich.

The mixture included latex emulsion in amounts 10 to 20 percent based on latex solids to cement weight. Placed during autumn 1957 and 1958, the patches exhibit improved shear bond, compressive and tensile strength, and have a lower water-cement ratio.



CORRUGATED METAL PIPE UNDERDRAIN



ONLY ONE FILTER GRADATION NEEDED

Graduation No. 1 is used to prevent migration of soil particles from trench wall which would cause silting of underdrain and settlement of surface.

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● **Underdrain details for the guidance of engineers and contractors.**

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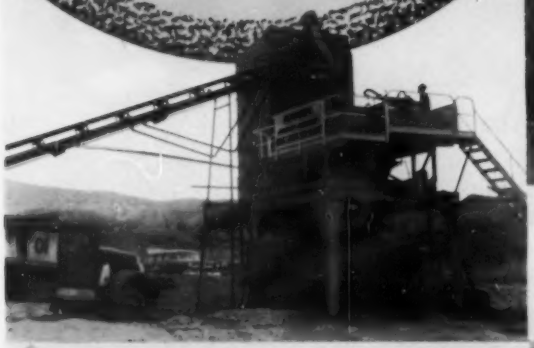

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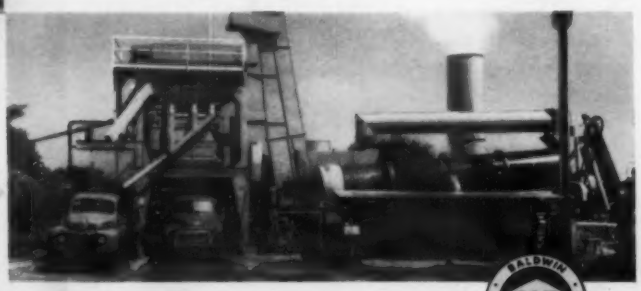

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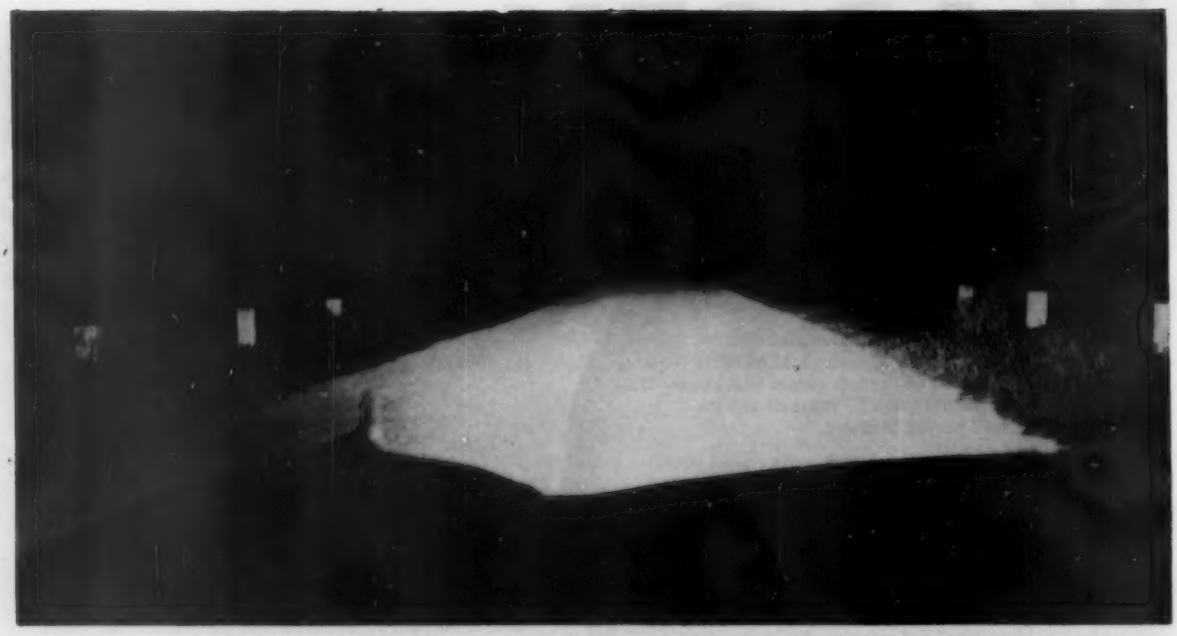

Excellent visibility in spite of rain—photo shows pavement of emulsified asphalt with limestone single-application seal coat.*

SAVINGS IN CONSTRUCTION plus SAFETY IN USE

Also taken in the rain — asphalt pavement (dense-graded high-type plant mix) without seal coat.*

The three photographs on this page are not retouched; they were taken by the same photographer from the same car with the same camera (with the same lens and speed setting) under similar weather conditions. If you are looking for good visibility and adequate skid-resistance along with economy of construction, it is a simple fact that *there is no lower cost way to get those properties* than by the proper use of emulsified asphalts and aggregates in seal coats. For further information, get in touch with your nearest McConnaughay Licensee (listed on the page facing this ad) or contact the main office below.

Raining again — conventional rigid-type pavement.*

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Table 9. Average Time Per Batch and Production Rates
For Mixer for Specified Conditions

Condition	Time per batch, min	Batches per hour	Production rates, tons per hour
For net productive time (see Table 3)	0.89	67.40	102.0
Add minor delays	0.20		
For net working time	1.09	55.0	82.5
Add major delays, excluding loss due to weather	0.23		
Subtotal	1.32	45.4	68.0
Add delay due to weather	0.28		
For total time	1.60	37.5	56.3

PRODUCTION ANALYSIS

Continued from page 150

facturing industry has followed a practice of conducting performance studies such as this, and from these studies improvements in production have been effected. Certainly the construction industry should derive considerable benefits from such studies.

Rubberized Asphalt Resurface Saved on Material

First use of rubber on a Portage County, Ohio, road was accomplished recently when a 5-mile section was resurface treated with rubberized liquid asphalt and crushed limestone. A synthetic rubber mineral powder, "Rubarite," developed by the Goodyear Tire & Rubber Company for paving applications was used. The powder made it possible to use 25 percent less stone and about 3 percent less asphalt than would have been considered normal.

The rubberized asphalt was applied on the old road surface by distributor truck at 0.2 gal. per sq. yd. going to 0.3 gal. where cracking in the existing surface was excessive. Trucks followed immediately with No. 6 crushed limestone at 20 lb. per sq. yd., and a steel roller left the treatment ready for traffic.

The 5.1 miles of two-lane highway utilized 13,000 gal. of liquid asphalt, 500 tons of crushed limestone and 3½ tons of Rubarite.

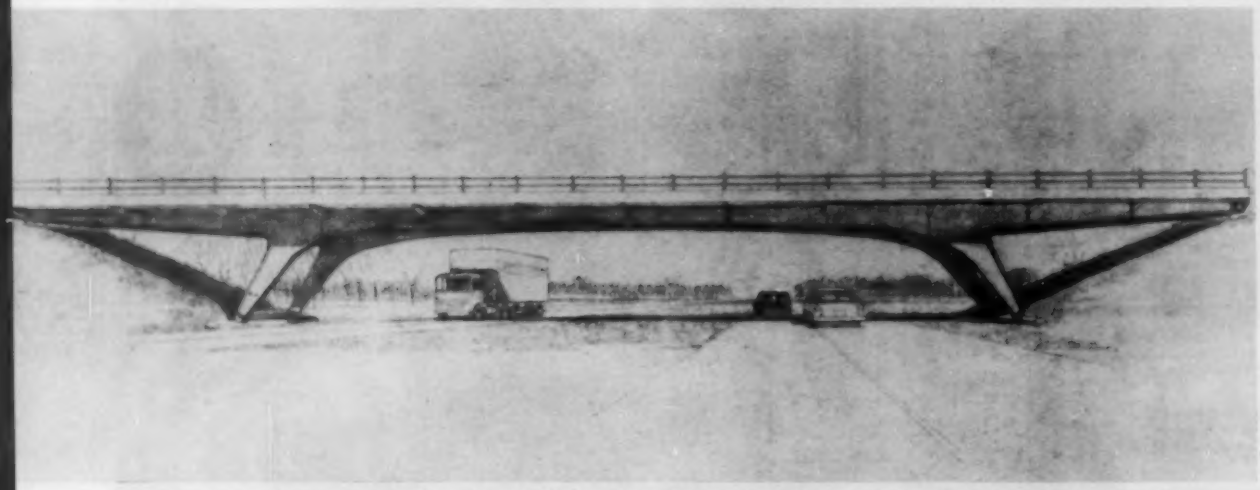
Applying "Rubarite" seal at 275 deg. Portage County, Ohio.

First prize ($15,000, professional) went to Allan M. Beesing, a registered professional engineer, Buffalo, N. Y., for this graceful arch of welded girders, clear-spanning a divided 4-lane expressway. Skillful combination of carbon and high-strength steels eliminates need for a dangerous and unsightly center pier.

Long, Graceful Overpasses Win Bridge Awards

Shown here are top two winners in the Steel Highway Bridge Design Competition sponsored by American Bridge Division of U. S. Steel. The competition which offered 15 professional and student awards totaling $44,000, attracted over 300 entries.

The object was "to stimulate more imaginative, effective and economical use of strong, modern steels in overpass structures that must bridge superhighways at frequent intervals." These steels are in the limelight because of the 40,000 bridges estimated to be needed for interstate and defense highways in the next 15 years.



First honorable mention ($10,000, professional) was given to Donald H. Olson, of Two Harbors, Minn., and Jorgen Tvilstegaard, Minneapolis. This economic and original design includes a strut-framed steel structure which arches in a clear (135-ft.) span over a 4-lane divided highway. Piers are located safely back from shoulders.

New Products

Continued from page 139

Desk Top Laminator

Known as the Apeco "Ply-On" laminator, this machine preserves and protects important business papers by completely encasing them in thin, pliable sheets of plastic film.

The new machine is simply operated by a push button; the full operation takes less than 10 seconds. Papers protected by the film are said to be impervious to moisture and will not crack when folded. They resist the action of

Apeco Laminator

most liquids and solvents, retain their clarity with age. A laminated document is protected from grease, dirt or ink smudges, and from becoming dog-eared and torn from handling.

American Photocopy Equipment Company, c/o The Public Relations Board, 75 E. Wacker Dr., Chicago, Ill.

For more details circle 143 on Enclosed Return Postal Card.

Hydraulic Pump Motors

A new line of hydraulic pump motors in NEMA frames 182 through 215 has been introduced by General Electric's Small Integral Motor Department. Designed with an adapter that allows the hydraulic pump to be motor-mounted, the new motor line is available in dripproof, enclosed or explosion-proof construction. The motors are available in all ratings now supplied in the 182, 184, 213 and 215 frames, nominally 1 through 5 hp. Pump mounting adapters can be supplied that will accept pumps of many manufacturers. These adapters are available on both ends of dripproof and enclosed non-ventilated motors.

The new motors, can be supplied with a flexible coupling that assures proper shaft alignment and substantially reduces any unusual bearing loads that might result from misalignment of the motor and the pump shafts.

General Electric Company, Schenectady 5, N. Y.

For more details circle 144 on Enclosed Return Postal Card.

Portable Power Supply

Offering 3,000 watts of output power, this Zeus Model GW-300 features a permanent magnet alternator which has no brushes, slip-rings or commutator. The unit is manufactured by Western Branch, Pesco Products Division, Borg-Warner Corporation.

The alternator, which utilizes a two-

Zeus, 3000 Watt Power Supply

poled permanent magnet is connected directly to a gasoline engine and is said to deliver a full-power rating for long periods of continuous operation without voltage loss or over-heating. Other features include recoil or electric start, non-integral fuel tank and air-cooled operation. Unit is 19 in. high, 16 in. wide and 21 in. long.

Western Branch, Pesco Products Division, Borg-Warner Corporation, 3310 Vanowen St., Burbank, Calif.

For more details circle 145 on Enclosed Return Postal Card.

Front Running Gear

Availability of a new rubber-tired front running gear has been announced by the Athey Products Corporation. The attachment is designed to allow crawler tractors to tow rubber-tired trailed units normally used behind rubber-tired prime movers.

The gear, or "dolly" forms a connecting link between the crawler tractor and the trailed unit. The accompanying photo shows the "dolly" mounted to an Athey PR20 Rear Dump. However, it is made in three sizes to mount to all the firm's trailers and Caterpillar scrapers for the Cat DW21, DW20 and

Athey Front Running Gear

No. 619 tractors. The gear unit is composed of a drawbar, axle member and one of three hitch members. The hitch member is in matched design to the desired scraper or trailer.

Athey Products Corporation, 5631 W. 65th St., Chicago 38, Ill.

For more details circle 146 on Enclosed Return Postal Card.

Grader Tire

A new road grader tire with improved traction has been introduced by B. F. Goodrich Tire Company, a division of the B. F. Goodrich Company. Called the "Power Grader" it has an all nylon cord body that is said to withstand double the shock of ordinary grader tires.

Extra-large tapered cleats that dig into the soil prevent slippage and its open center tread design promotes better cleaning. A new design with wider heel-to-heel measurement at the beads, makes the tire easier to mount and demount, the manufacturer states. The tire is available in sizes 9.00-24 through 18.00-26 with ply ratings from six to fourteen. A smooth-tread tire of this type is made in size 13.00-24 for use on freshly worked macadam roads.

B. F. Goodrich Tire Company, B. F. Goodrich Company, Akron, Ohio

For more details circle 147 on Enclosed Return Postal Card.

For Better Patches Heat and Remix Stockpiled Asphalt with

HEAT-A-MIX

TAILGATE ASPHALT MIXER

For heating and remixing stockpiled asphalt. Can be operated in forward and reverse for better blending of material. No fire in pugmill—asphalt made hot and workable by indirect heat. Has its own gasoline engine and propane or kerosene heating system. Mounts quickly and easily on truck tailgate. Removable and adjustable legs make it easy to transfer unit from one truck to another without use of crane or hoist.

HEAT-A-MIX

WYLIE MANUFACTURING CO., INC.
P. O. BOX 7086 • OKLAHOMA CITY 13, OKLA.

. . . for more details circle 348 on enclosed return postal card

New Products

Big Capacity Shovel

The combination of big capacity, high efficiency and extreme ruggedness has been engineered into the new Lima types 1800 and 1800-SC introduced by the Lima Works, Construction Equipment Division, Baldwin-Lima-Hamilton Corporation.

As a standard shovel, the 1800 is equipped with a 35-ft. boom, 26-ft.-10 in. dipper handle and five cu. yd. dipper; as a crane it has a lifting capacity of 112 tons, dragline capacity is variable. The type 1800 SC is a 140 ton capacity crane, said to have ground-gripping stability. Extra long crane booms with jibs are available for high lift work. Both units are air operated and designed to knock down for job to job transportation.

Baldwin-Lima-Hamilton Corporation Construction Equipment Division, Lima, Ohio

For more details circle 148 on Enclosed Return Postal Card.

Lima Shovel-Crane

Inflatable Shelter

Shown here with its optional air-lock vestibule, is the Hoosier Air Structure, developed by Hoosier Tarpaulin and Canvas Goods Company.

The structure is made of high-strength vinyl-coated nylon and supported by low pressure air from a small blower. It also can be heated by venting in a small heater. The structure is said to be simple to erect, and when not in use can be folded or rolled in a box small enough to be handled by station wagon or pick-up truck. Sizes range from 20 ft. by 30 ft. with 10 ft. of height, to 60 ft. by 120 ft. with 30 ft. height; floor space is completely usable as there are no inner structures or supports.

Hoosier Air Structure with Vestibule

Hoosier Tarpaulin & Canvas Goods Company, Inc., 1302 W. Washington St., Indianapolis 6, Ind.

For more details circle 149 on Enclosed Return Postal Card.

Two-Way Radio

A compact, transistorized mobile radio designed to minimize communications costs has been announced by the Radio Corporation of America. The RCA LD-150 is available in 30 or 60 w. models and can operate on any frequency in the 148-174 megacycle band.

The transmitter, receiver and power supply are housed in a steel, dust-resistant, cabinet suitable for mounting under a vehicle dashboard. The control unit can also be dash-mounted separately, with main equipment case stored in rear or in truck cab. The unit's printed circuits are clearly numbered in road map fashion as an aid to easy maintenance.

Radio Corporation of America, 30 Rockefeller Plaza, New York 20, N. Y.

For more details circle 150 on Enclosed Return Postal Card.

Gas Tank Cap

A new plastic gasoline tank cap that eliminates fuel leakage and reduces fire hazards has been introduced on some engines produced by Clinton Engines Corp.

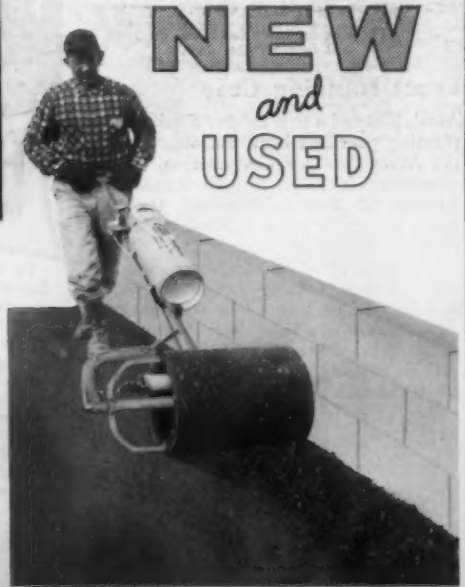
The cap is designed to do away with spillage caused when engine vibrations expel fuel from a full or nearly full gasoline tank. Engineered to fit on a specially-machined metal lip of the gas tank, the cap forces gasoline that would normally spill to run along the lip drain and back into the tank. Two slits in the cap provide air vents without affecting the cap's sealing qualities.

Clinton Engines Corporation, c/o Allied Public Relations, Inc., 250 Park Ave., New York 17, N. Y.

For more details circle 151 on Enclosed Return Postal Card.

ELLIS

NEW and USED



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FACTORY TRADE-INS

CRANES — SHOVELS — HOES — DRAGLINES

1¼ yd. Bay City 65 crane with 60 ft. boom, Caterpillar engine. 1946 model in good condition with power boom hoist and third drum. Crawlers are 12½ ft. long and 12 ft. wide. Located in New York. #4714

3 yd. P&H 1055 shovel with 28 ft. boom and Buda diesel engine. Has power boom hoist, high gantry, Kohler light plant and electric-hydraulic controls. In good condition, located in Illinois. #10475

4 yd. Marion 111-M shovel with 30 ft. boom and 23 ft. 8 in. handle. Caterpillar diesel engine with gas start. Air and electric controlled with power boom hoist and high gantry. In good condition, 1952 model. Crawlers are 16 ft. long and 14 ft. 8 in. wide with 36 in. shoes. Located in New York. #9684

¾ yd. Marion 35-M drag-clam with 70 ft. boom and GMC engine. Has 12 ft. 9 in. long crawlers, 10 ft. 7 in. wide with 36 in. pads. Full air controls with independent boom hoist and high gantry. 1958 model in excellent condition, located Arkansas. #21939

¾ yd. Marion 32-M dragline with 45 ft. boom, Continental gas engine. Has power boom hoist, manual controls. Built in 1955 and in good condition. Crawlers are 11 ft. 4 in. long, 9 ft. 11 in. wide with 25 in. pads. Located in Ohio. #21369

1 yd. Marion 43-M hoe with 24 ft. boom, 11 ft. handle. GMC engine with torque converter. Crawlers 13½ ft. long, 11½ ft. wide with 36 in. pads. Fully air controlled and in excellent condition, new in 1948; located in Ohio. #22028

¾ yd. Marion 35-M shovel with 18 ft. 8 in. boom and 16 ft. 4 in. handle. GMC engine, power boom hoist, 5150 lbs. ballast. Crawlers are 11 ft. 4 in. long and 9 ft. 11 in. wide with 25 in. pads. Full air controls and in excellent condition, 1956 model, located in Kansas. #21731

2½ yd. P&H 855 dragline with 17 ft. long, 12 ft. 4 in. wide crawlers, 75 ft. boom. Has Caterpillar engine and Kohler light plant. Good condition, 1946 model, located in Pennsylvania. #7957

2½ yd. Bucyrus-Erie 54-B shovel-dragline with 85 ft. drag boom and 42 ft. shovel boom with 38 ft. handle and 2 yd. dipper. Has Caterpillar engine, high gantry, manual controls, running boards all around and Kohler light plant. Good condition, 1947 model, located in Pennsylvania. #41735

2½ yd. P&H 955-A shovel-dragline with 70 ft. boom. Powered by Waukesha engine. Has 15 ft. 7 in. long, 12 ft. 6 in. wide crawlers. Kohler light plant and extra parts—in good condition, new in 1951, located in Arizona. #14844

3½ yd. Marion 111-M shovel with 43 ft. boom, 34 ft. handle. Powered by GMC diesel engine. 20 ft. long, 15 ft. wide crawlers. Has high gantry, Kohler light plant, in fair condition, new in 1947. Located in Pennsylvania. #8607

¾ yd. Marion 35-M hoe with 20 ft. boom, Amsco dipper with 38 in. side cutters. GMC engine, air controls, power boom hoist. Excellent condition, new in 1956, located in Virginia. #21676

MARION POWER SHOVEL COMPANY
MARION, OHIO

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WESTERN UNION-WXMS MARION, OHIO

P.O. BOX 505
PHONE 2-1151

LORAIN

2 yard Front End Loaders

2½ yard Combination Shovel, Crane, Dragline

1 yard Basic Machine with Shovel or Hoe Front

7 ton Self-propelled Crane (excellent for material handling)

½ yard Backhoe (Link-Belt)

Low cash price for Pre-Winter Clearance.

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Phone GR 5-2196

BARGAINS

3—TDT Euclid Scrapers .....$30,000.00 (For the three)

2—LaTourneau Scrapers .....$8,500.00 ea.

1—Model 1201 Lima Dragline

1—Model 80D Northwest Shovel and Drag. (New in 1957)

1—Model 80D Northwest Shovel. 1951.

1—Model 6 Northwest Shovel and Drag. New in 1956.

EUCLIDS—Rear Dump. Low hrs.

1—Model 1055 P&H Shovel—3½ yd. New 1956.

1—Model 120B Bucyrus-Erie Shovel—3 yd.

3—FDT EUCLIDS, Bottom Dump. $6,500.00 ea.

"Other Bargains available, not listed".

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Construction Equipment
311 W. Diamond Ave., Hazleton, Pa.
Gladstone 5-4041-5-0253

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Generating Sets Test Run only—with spare parts

2—12.5 K.V.A., 240 Volt, 3 Phase—Gasoline

1—31.3 K.V.A., 230 Volt, 3 Phase—Diesel

3—GE Electric Motors New in Crates, 75 H.P., 440 Volt—3 Phase, 60 Cycle, 700 R.P.M. Model 5K 6323XC Frame 6323P

Berlanti Construction Co. Inc.
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HARRISON, NEW YORK
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CRUSHING EQUIPMENT

Universal TD24 Portable Gravelmaster, 1024 R.B. jaw, 24" twin roll, 3x10, 3½ deck screen; rotovator. In perfect condition. 200 TPH.

Universal TDS-30 Portable Screening & Crushing Plant, 30" twin dual roll, 3x12—2½ deck screen, rotovator, 30" conveyors, Cat Diesel.

19 TRANSIT MIXERS

Rex 6 Yd. Adjusta-Wate Mixer, flush tank, Chrysler power, on International LF190 tandem—new 1953—ready to go.

Rex 5 Yd. Mixer, flush tank, Chrysler power, on 1955 GMC 620 tandem, air brakes. Rebuilt.

Rex 3½ Yd. Mixer, large tank, Chrysler power on International LF174 5-speed, 3-speed, perfect.

Smith 4½ Yd. Mixer, small water tank, Continental power, open end, good shape—late model.

CRANES & SHOVELS

1—Lorain "TL-25K" ¾ yd. Diesel Dragline, rebuilt.

1—Insley "K-12" ½ yd. Trench Hoe, rebuilt.

4—Bantam "M-49" ¾ yd. Hoes or Draglines mounted GMC 6x6's.

1—Bantam "H-47" Mounted on Chev. 4x4, Hoe or Drag, priced low.

1—Manitowoc "2000" Used Shovel Attachment.

1—P&H 225A *New* Shovel Attachment, complete, discontinued.

1—Lorain "TL-20" *Used* Shovel Attachment.

All the Above Equipment is Located here in Rockford!

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150 DUMP TRUCKS AND TRAILERS

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Dual Lane, Bolted • Weight 718 Tons
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(10) 2 c.y. Johnson Concrete Buckets
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(1) 4 c.y. Owens Clamshell Bucket
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4—1957-14-TDT (6 Wheels) Euclid Scrapers, 18 cubic yd., Cummins engines, good rubber offered as is or rebuilt.

2—Used TS-300 Allis-Chalmers rubber-tired Scrapers, 14 yd. struck capacity. Good condition, 1955 machines.

4—Used 1955 Model TS-360 Allis-Chalmers rubber-tired Scrapers, 15 yd. struck capacity.

2—Used Model CR LeTourneau 12 yd. Scrapers, (1949), Cummins diesel engine powered. Excellent condition.

5—Used Euclid 13 yd. Bottom Dumps. Excellent shape. Mod. 71FDT and Mod. 38FDT with GM 6-71 engines.

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Lima 802 Shovel, Ser. #5050 (2 yds.), with Cat. D17000 Diesel Engine. Located at Wyco, W. Va. Good Condition. Price $12,500 as is, where is. Price $12,500 as is, where is.

Northwest No. 6 Shovel, Sed. #8944 (1½ yd.) with Murphy Diesel engine. Located at Clarksburg, West Virginia. Good condition. Price $17,500.

Cat 75 Bulldozer, for use with No. 25 Control. Good condition. Price $1,250.

GREGORY-POOLE EQUIP. CO.
P. O. Box 469 - Tel. TE-4-3447
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"WANTED:

1—1 yd. Dragline
Long and Wide Crawlers
3 Self-Propelled Motor Scrapers
12 to 15 yd. capacity

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DEPENDABLE USED MACHINES
P&H #150 ½ yd. Dragline
Adams Tandem Grader 42-C
Lorain 20 ton truck crane
Lima #34 Paymaster backhoe
¾ yd. Lorain TL25K Dragline
#360 Hopto on 6x6 Army Carrier
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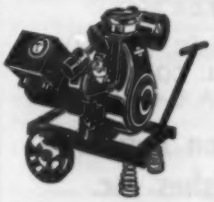
CONTRACTORS 3000-WATT DC PLANT



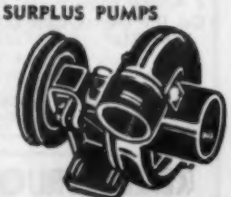
• **ITEM #667** - Portable 3 KW DC power plant on wheels. Easy to move from job to job. Plenty of output for contractors, builders, etc., to operate lights, heaters, AC, DC universal motors, portable saws, drills, floodlights, chain saws, etc.

• Engine is 6 h.p. Standard Wisconsin. Generator rated 3000-watts, 115-volts, 28.5-amperes direct current. Other features are voltmeter, field rheostat, outlets and overload protection. Size 28" x 21" x 34". Shipping weight 300 lbs. Cost Gov't $435.00. **SALE** - F.O.B. **$169.50**

STANDARD DIAL TELEPHONE

• **ITEM #716** - Western Electric dial telephone transmitter and receiver. Clear tone bell. Excellent extension phone or extra phone on private automatic system. Same type used throughout nation. Size 9" x 8" x6". Shipping weight 8 lbs. Original Cost $29.50. **SALE** - F.O.B. **$10.39**

NAVY SURPLUS PUMPS



• Top buy in ball-bearing, all bronze, high efficiency centrifugal pumps. Now made available at less than cost of manufacture.

• **ITEM #200** - Brand new Model R-200 bronze, ball-bearing, high capacity centrifugal. Contractors use for draining, dewatering, filling tank trucks, irrigation, etc. Capacity to 280 g.p.m. Pressure to 35 lbs. Clockwise rotation. Complete with 6" pulley. Inlet 2½", discharge 2". Dimensions: 9" dia., 11" ht. Weight 40 lbs. List $102. **SALE** - F.O.B. **$49.50**

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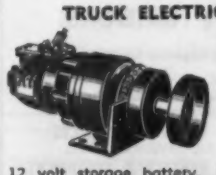

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• Operates on 6 12 volt storage battery. Powerful, fully reversible, ball-bearing winch.

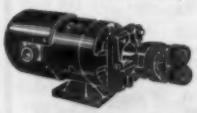
• Load capaciyt at 6 volts, 1000 lbs.; at 12 volts, 2000 lbs. Holds 40 feet of ¼" cable. Cable speed 8 to 15 feet per minute.

• Dimensions: 7" high 9" wide, 17½" long. Weight 49 lbs. Cost Gov't $280. **SALE** - F.O.B. **$46.71**

20 FT. 1¼" WATER HOSE WITH FITTINGS

• **ITEM #217.** Brand new surplus water hose. Spiral wire interwoven with strong mesh braid provides strong re-inforcement, and makes this ideal for suction or discharge hose. Inside diam. 1¼", male 1¼" pipe thread fittings on each end. Pressures to 75 p.s.i. Wt. approx. 12 lbs. Cost Gov't. $16.50. **SALE.** Ppd. in U.S.A. **$7.69**

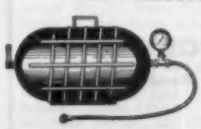
ELECTRIC HYDRAULIC PUMP



• **ITEM #920** - Brand new Pesco electric hydraulic gear pump. Excellent for use on lift trucks, loaders; other hydraulic applications.

• Operates on 12 to 24-volts DC. 1000 p.s.i., 3-g.p.m. @ 24-volts. Built in relief valve, ball bearings. Motor 2¼ h.p. @ 24-V. Inlet and outlet ports, ¾" -14 female threaded. Size 15" x 7" x 6". Shipping weight 35 lbs. Cost Gov't $175.00. **SALE** - F.O.B. **$16.95**

AIR PRESSURE TANKS



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ITEM #472—Contractors Pressure Unit. Consists of stainless steel tank 10 x 15 with Schrader valve, pressure gauge, tire chuck and blow gun. Hundreds of uses. Inflate tires—blow dust from machinery. Wt. 12 lbs. Cost Govt. $33.50 **SALE** .....**$14.95** FOB

ITEM #447-A—6x24 500 cubic in.. **4.95**
ITEM #448-B—10x18 1000 cu. in..**10.91**
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GEAR SPEED REDUCER

• **ITEM #1310** - Gear reduction unit gives amazing torque and power to drive small winches, slow speed power tools, augers, drills, revolving signs, door openers, etc.

• 80 to 1 reduction gear reduces standard, electric motor to 21 r.p.m. Input shaft ⅜" diam. Output shaft 1¼" diam. 6 steel gears, 8 roller bearings. Size 6½" x 6¼" x 4½". Shipping weight 5 lbs. Cost Government $66.00. **SALE** - Ppd. in U.S.A. **$8.98**

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• Hydraulic Pressure Gauge 0-1500 lb..	**3.49**
• Hydraulic Hand Pumps	**10.95**
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• Powerful Geared Motor 12-v DC	**19.46**
• Contractors Engine Driven Pump ...	**138.00**
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• Navy Type 7x50 Binoculars	**26.81**
• Heavy Duty Finest 12x20 Tarp	**19.69**
• 3000-w 115-v DC Generator	**58.75**
•AC Power Plants 1000 to 5000-W..	**Write**
• 0-120 Amp AC Ammeter	**9.39**
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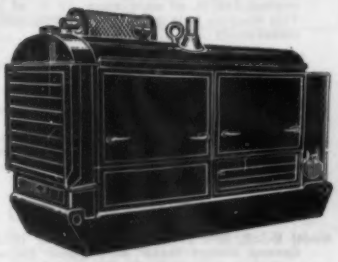
• Hundreds Electrical-Electronic Bargains	**Write**

7500/10,000 WATT AC POWER PLANT



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From '59 models to '49.
Large Inventory

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SALES — OR 3-1200

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2¾ Yard Tractor Shovel, S/N 18850DW, 18:00x25, 12 ply rubber with one spare, recently rebuilt, excellent condition. $15,500.00 F.O.B. Powers, Michigan.

OLIVER OC-12 LOADER

1½ yard capacity, diesel Crawler Demonstrator with a new machine guarantee. A bargain at $7900.00 F.O.B. Powers, Michigan.

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8-Yard Scrapers, powered with GMC Diesel. Demonstrators, excellent condition, sacrifice at $10,900.00 ea. F.O.B. Powers, Michigan.

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Ready-Mix Operators

1—Complete Plant, 150 T Agg. 1500 Bbl. Cement Storage, 3 Elevators, Hot Water.
5—Assorted Mixer Trucks.
Portable Plants — Mixermobile, Binabatch on Wheels, Scoopmobiles, Misc. Trucks

JESS RAY
103 Shell Bldg. — LU 4-1019
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Save 50 To 80%

GAS and DIESEL . . . Have your Cylinder heads rebuilt. Preheated and gas welded, machine complete ready to install. Factory guarantee. Exchange service on popular models.

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Since 1938 - Phone No. 3
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WANTED

Used 1½ to 2 yd. shovel or equivalent size crane to handle shovel front. Send all data first letter.

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DROP FORGED STEEL HICKORY HANDLED ALL NEW

8# D. Face Handled	$3.00
10# D. Face Handled	3.80
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16# D. Face Handled	6.50
6# Napping Hammer	1.75
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3500 Manitowoc Drag, 80', 2½ yd.
54-B B.E. Drag, 80', 2½ yd.
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54-B B.E. 2½ yd. Standard Shovel
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Near St. Louis
LIMA 604 - BACKHOE ATTACHMENT
FOR SALE

Primary Plant 3x10; apron feeder 36x40; Dixie Hammermill; UD-24 International Diesel Engine; 24" conveyor, 24' long for discharge to secondary machine.

Secondary Machine equipped with a 42x30 Gruendler Hammermill; 4x10 double deck Seco screen; D-1300 Caterpillar Diesel Engine; end conveyor 20" wide x 22' long; return conveyor 20" wide x 16' long. This is a closed circuit machine.

These 2 Units are all mounted on exceptionally good rubber and can be transported very easily. This plant is ready to pull into your pit and start crushing, after November 1, 1959. Now in operation in Southern Illinois.

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Backhoe Attachment for Lima 604 Crane. Perfect Condition, Never Used.....$6,000.00

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Here's LOW COST Loading-Screening

KOLMAN CONVEYOR

Single-deck vibrating screen folds into towing position without dismounting screen or any of the drive assembly

Rugged construction of Model 202 permits use of double-deck KOLMAN screen to make several sizes of material at once.

Model 202, 40' x 24', 6' x 16' Model 58-60 Screen, Model VH-4, 17 to 30 HP Wisconsin gasoline air-cooled engine, attached Reciprocating Plate Feeder, Hopper and roof type grizzly bars.

Rugged Box-Type Construction Permits Amazing Low Price

The Model 202 meets the demand for a conveyor in the low price field stout enough to carry a large single or double-deck vibrating screen and loading trap in a completely portable conveyor-screen plant.

"Box-Type" Construction

The rugged "box-type" construction of the Model 202 conveyor gives it unusual strength and rigidity. The sides are fabricated of 3/16" steel plate formed into a channel 16" deep with 2" legs. The steel belt cover reaches completely across the top, completing the box and completely encasing the return belt to prevent materials from working in to cause belt damage.

The under-slung power unit provides easy access for servicing and operation.

Folding Feature

The 202 is available with the Head Pulley Clutch feature which allows the belt to be stopped and started while the vibrating screen remains in operation.

The KOLMAN Model 202 is rugged enough to carry a loading trap and large vibrating screen without additional support. It will take the kind of punishment that is dished out in a portable outfit—and will cost you far less money to own and operate. Available in 18" or 24" belt width, in lengths up to 50'.

Write for Literature and Prices

KOLMAN MANUFACTURING CO.
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FOR SALE
Cat No. 12 MOTOR GRADER
Warranted

8T series with cab, lights, starter. 6 full recapped 13:00x24 tires like new. Completely shop checked. In top condition.

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COMBINATION DRAGLINE BACKHOE
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Good Condition, Long Wide Tracks, $4,500

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Suitable for—

PIPE-LINES, WELL CASINGS, CULVERTS, ETC.

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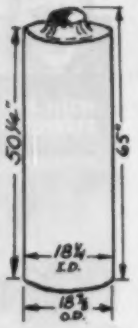

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Scrapers—4 and 6 wheel
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Caterpillar No. 955 Traxcavator, S/N 12A3739.
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Ferguson 50 Ton Pneumatic Roller RT 100 S.
Ingram 10 Ton 3-Wheel Roller, S/N 57992-D32 w/Torque Converter Drive.

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Only Two Left - NEW MODEL 3000

Manufactured in 1955, including: Shovel Boom, Sticks, Bucket, complete with Padlock Sheave and Bail; long & short Crowd Chain, Retract Chain, right Sprocket Lagging, Boom hinge assembly, Chain Tightener, Retract and Dipper Trip parts on main drive shaft, all controls, Shovel Gantry & all new cables. Everything to convert crane or dragline to shovel. 24' Boom, 18' Stick, 1¾ C. Y. Bucket.

Price - - - $2,900.00

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FOR SALE - 1055 P & H SHOVEL BOOM & BUCKET

30' boom plus one set of 27' sticks and one set of 18' sticks. 3 yard P&H heavy duty bucket, serial No. W3233. Used only two months, excellent condition.
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Telephone: Philipsburg, Pa., Dickens 2-1767

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UNUSED 3-TON ALL WHEEL DRIVE DUMP TRUCK

1 Only—Model M5H6 International 6 x 6 with RED 361 Engine

5-Speed Fuller Transmission
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4-Yard Dump body with 5-Yard ends
12,000# Front mounted winch
Chassis processed and preserved in Feb. 1958 by the Government and new Garwood body installed by us

This truck is ideal for rough construction jobs where conventional trucks cannot operate.

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SFDD — 50,000 Lbs. Rear Axles
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Main and Auxiliary Transmission.
Buy these reliable trucks for that contract.
They'll work and stay working with the best.

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NEW WIRE ROPE CABLE

1000 Ft. Spools

Reg. Right Lay 6x19 Improved Plow Steel, Preformed Bight Hemp Center. Price per ft: 3/8-11¢, 1/2-14¢, 9/16-17¢, 5/8-19¾¢, ¾-26¾¢.

Steel Center Reg. right lay or Lang Lay Drag Cable. Some galv. Hemp Center, per ft.: 3/8-13½¢, ½-17¢, 9/16-19¾¢, 5/8-21¢, ¾-30½¢, 7/8-37½¢, 1-47¢.

Prices are F.O.B. Jacksonville, Florida.
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For JEEPS AND TRUCKS
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On 5-ft., 6-ft., 7-ft., 8-ft. Blades

When Inquiring include Make, Model, Year and Cylinder of Vehicle.

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Wiley Roadmaster 1520
Asphalt Plant, demonstrator.....$10,500

American single 48" Sheepsfoot, demonstrator..... $450

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GM Power $3,500

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SUBJECT TO PRIOR SALE

1—American, Model 195BC. Combination Dragline and Backhoe. Diesel Power, less than 1000 hours use. Like New.

1—Clyde 70' Builders Tower with Clyde Tower Derrick. Very Good. Will Sacrifice.

1—Used Model "K" C.M.C. Roll-O-Hoist complete with two extensions to 48' height. With 3 H.P. Electric Motor Drive with Forward and Reversing Hoist Drum. Will Sacrifice.

1—Used Murphy Model ME-4. Skid Mounted. Power Unit, clutch, Power take-off Drive. Fan and Radiator cooled. Extra Good.

1—C.S. Johnson Elevating Charger, complete with Gas Power, Undertrack screw, 2—#14, 1000 lb. beam manual Batchers. Used on two jobs. Good.

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Very Low Price

Steel Forms for Tunnel or Culvert Manufactured by Blaw-Knox Company

2—Collapsible inside forms 40' long x 30' wide x 15' high, curved top, for single tube

4—Exterior forms 40' long x 16' high

4—Collapsible inside forms 40' long x 30' wide x 15' high, curved top, for twin tube

2—Exterior forms 40' long x 16' high

Also steel forms for air duct and walkway

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INTERNATIONAL TD-9 Drott Loader. Guaranteed.

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Chesterman metallic tapes leather case linen line with eighth copper wires—10ths or 12ths
50 ft size @ $ 7.95 ea.
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Satisfaction guaranteed
Ask about our surplus new tapes.
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8½ yd. Bucyrus-Erie Shovel
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5 yd. Bucyrus-Erie Dragline
2½ yd. Northwest Shovel
3½ yd. P&H Shovel
1½ yd. Marion Shovel
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3 yd. Lima Dragline
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Construction Equipment
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Gladstone 3-4041 - 5-0253

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2400 Lima 6½ yd. Shovel.
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3500 Manitowoc 2½ yd. Dragline.
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4161 Marion 5 yd. Shovel.
38-B Bucyrus Erie 1½ yd. Shovel.
46TD Euclids, 22 ton, rear dump.
65TD Euclids, 27 ton, rear dump.
49FD Euclids, 15 ton, rear dump.
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175-A Michigan Front end Loader.
38-B Bucyrus-Erie Shovel Attachment.

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520 " Carnegie MP-116-25, 30, 40'-Fla.
No. 400 & 800 Vulcan Pile Extractor
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Intermediate grade deformed reinforcing bars sizes #3, #4, #5, #6, #7, #8, #10 and #11
40' and 60' Lengths
Also available - 160 tons No. 1 60# relaying rails located at New Iberia, Louisiana. Contact:

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GLAZER STEEL CORPORATION
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Model 502A LeRoi, 4 cyl. Eng., mounted on 4 pneu. tires. Used 6 months, in good shape $2,000

HD-14 ALLIS CHALMERS
1 Set Cat Pads and Rails - 75%.
Single and double flange rollers.
Front Idlers - 75%.
All other parts - less engine.

NW 105 UNDERBODY COMPLETE
Will Sell Parts.

10 Ton, 3 wheel Roller. Ford Engine. $1,000.00.

SABADASH & SABADASH
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LINCOLN PARK, MICHIGAN

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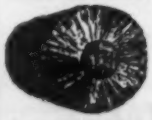

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Brushes for Every Industrial Need

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FOR SALE

1—Koehring 34E Dual Drum Paver SN 27332, with 4 Cyl. Model 4057-C GM Diesel engine, SN 4A-57145. Used only parts of 3 seasons. In good condition. Located in Iowa.

1—Koehring 34E Dual Drum Paver SN 24190, with 4 Cyl. Model 4057-C GM Diesel engine SN 4A-51383, new 1955. This paver has had only standby use last three seasons. Paver is in good working condition. Located in Iowa. Fred Carlson Co., Inc., Box 35, Decorah, Iowa.

Court Decisions

Contractors Not Responsible

The contract for the construction of a stretch of the Atlanta Expressway included provisions requiring the contractor to maintain warning signs and barricades where necessary. The character of the job demanded that access be maintained for subcontractors and others engaged in the construction work. The driver of an automobile who had entered the section under construction at one of the entrances thereto—the testimony at the subsequent trial was indecisive in regard to the precise point of entry—became involved in a collision with a pickup truck owned by a subcontractor on one of the bridges. The subcontractor sued both the driver of the automobile and the general contractor.

The Georgia Court of Appeals, Division 2, after a thorough review of the evidence, ruled that the general contractor was not responsible for the accident. It pointed out that the driver of the automobile was driving recklessly at a speed of 70 miles per hour, that there was no defect in the road and that warning signs had been put up by the general contractor at the entrances to the section under construction, thus making the reckless actions of the driver of the automobile the proximate cause of the accident. (Matheson v. Charles R. Shepherd Inc., 107 S.E.2d 897.)

Safety Liability

Responsibility to the public for taking the proper safety precautions may belong to the prime contractor for the entire duration of the work. The failure of the subcontractor to properly protect his own part of the work does not, of necessity, remove the burden of damages from the general contractor.

The Supreme Court of Errors of Connecticut in Kisziw v. Wm. P. Bray Co., 141 A 2d 244, ruled that the general contractor's obligations under his contract do not end when he finishes that portion of the work he chose to do himself. He has an obligation to the public and cannot relieve himself of liability by delegating part of the work to someone else.

Manufacturers' Literature

BASE STABILIZER PLANT: A current catalog-bulletin that illustrates and describes Madsen's portable Highway-Airport Base Stabilizer Plant with a 600 tph capacity is available from the Madsen Works, Construction Equipment Division, Baldwin-Lima-Hamilton Corporation, 14120 E. Rosecrans Ave., P. O. Box 38, La Mirada, Calif. The unit has been designed for ease of portability and assembly and mechanical simplicity. Auxiliary components available are cold feeder, feed conveyor and bulk cement silo. Back page of the publication gives complete list of specifications and data.

For more details circle 161 on Enclosed Return Postal Card.

CONTRACTION JOINT FORMER: A booklet available from the American Sisalkraft Corporation, 55 Starkey Ave., Attleboro, Mass., explains in detail the use and advantages of the company's new Joint Former, a plastic strip method for forming contraction joints in Portland cement concrete pavement. Contraction joint theory and a comparison of major joint forming methods in use today are also covered in the booklet. Actual sample of the plastic strip is included.

For more details circle 162 on Enclosed Return Postal Card.

¾ YARD CRAWLER: A new 20-page catalog describes and illustrates a ¾ yd. crawler convertible to crane, dragline, clamshell, shovel and hoe, and is available from Bay City Shovels, Inc., Bay City, Mich. As an erector's crane, this unit, in the company's Series 40, is available as a 20-ton crawler crane, 25 and 30 ton truck-mounted Cranemobile and 25-ton self-propelled CraneWagon. Detailed photos of the major parts and assemblies are shown in 55 pictures with 23 job photos. The carrier comes with 8 and 9 ft. widths and single or tandem front axles.

For more details circle 163 on Enclosed Return Postal Card.

TRAILER AND TRUCK BODIES: A new catalog is announced by The Binkley Company, Warrenton, Missouri. The publication consists of 191 pages of trailer and truck body sections, structural parts and components, including a complete line of landing gears, load equalizers, sliding tandems, hardware, tire carriers and miscellaneous roll formed metal shapes. Also included are drawings, dimensions, specifications, part numbers, general information and price list.

For more details circle 164 on Enclosed Return Postal Card.

DRAFTING AIDS: "Keep It Clean!" a six-page, gatefold bulletin describing materials to help draftsmen clean and protect drawings is offered by Keuffel & Esser Co., Adams and 3rd Sts., Hoboken, N. J.

Order numbers and prices are listed for cleaning aids and protective spray marketed by K&E.

For more details circle 165 on Enclosed Return Postal Card.

TRANSMISSION EXPLANATION: A step by step explanation of how the new "SynchroTouch" transmission control operates is given in new 8-page booklets issued by Caterpillar Tractor Company, Peoria, Ill. on the 345 hp Caterpillar DW20 and DW21 Series G. tractors. Schematic drawings illustrate the sequence involved in "shifting" by dialing the desired gear. As an example, when shifting from 2nd to 3rd gear, the schematic shows the master clutch disengaging, the shifting collar disengaging from 2nd gear and putting the transmission in neutral. The generators indicate when transmission gears are synchronized and the shifting collar then engages third gear followed by engagement of the master clutch.

For more details circle 166 on Enclosed Return Postal Card.

WHAT ABOUT YOU, MR. READER?

Are you still active in the field? Have you moved or changed your position?
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Even if you think we know all about you, please fill in the information requested below and send to us by return mail. Our auditors require proof of accuracy of our mailing list. *You* are the only person who can help us on this. Do it now before you forget, so you can be sure your magazine will always be properly addressed to you. New names cannot be added or old names retained on our list unless we have *all* this information. *Please print or type.*

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Manufacturers' Literature

SUBDRAINAGE PIPE New Literature from the Republic Steel Corporation, 1441 Republic Building, Cleveland, Ohio, announces its new "LOK-COR" subdrainage pipe. The literature describes the positive lock seam and helical corrugations which gave the pipe strength and flexibility to withstand heavy loads. Its construction from Republic galvanized copper steel gives it resistance to corrosion, the manufacturer states. The pipe is available in 20-ft. sections in 6 in., 8 in., and 10 in. diameters, perforated or non-perforated. Request form no. Adv. 1104.

For more details circle 167 on Enclosed Return Postal Card.

PRESTRESSED CONCRETE: Studies of 16 outstanding prestressed concrete projects covered in this 20-page Master Builders Company publication depict the unlimited applications for high quality prestressed concrete. Photographs and job stories cite the role played by Pozzolith in achieving the concrete qualities required for prestressed work. A prestressed lift slab, 120 feet long prestressed bridge girders, and a 2-million gallon prestressed water tank are some of the projects covered. Both pretensioned and post-tensioned projects are featured. For a copy of Bulletin MBR-P-13, write: The Master Builders Company, Cleveland 3, Ohio.

For more details circle 168 on Enclosed Return Postal Card.

WRENCH SIZING: A simplified method for figuring correct wrench size for any bolt or nut diameter is included in a new catalog from Lowell Wrench Company, Worcester 4, Mass. Shown is the company's complete line of reversible ratchet wrenches, including their new ½ in. square drive socket sets, available in "10-point" and conventional 12-point sizes. Full specifications and details are given for Warnock Strap Wrenches and Swaco Railroad Car Movers and Hopper Car Wrenches. Reversible ratchet wrenches for special applications are also described. Write for Catalog 62.

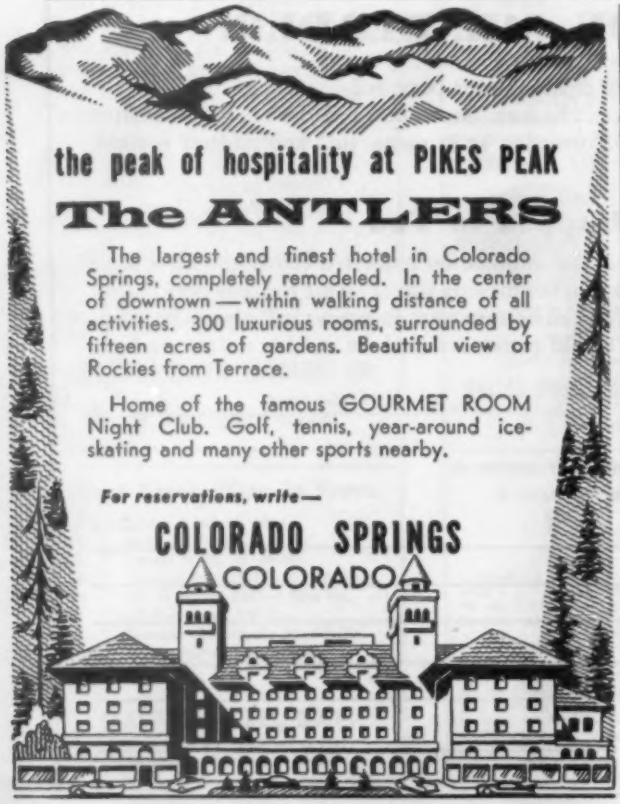
For more details circle 169 on Enclosed Return Postal Card.

RADIAL PRESTRESSING: An illustrated booklet from the Radistres Company, 1924 Temple Drive, Tallahassee, Fla., describes and pictures the process of radial stressing of concrete. Where prestressing is normally done with tendons stretched in one direction, in radial prestressing, elongated encircling steel bands bind the casting under great compressive forces in all directions. Elongation of the tendons is accomplished by a tensioning frame which holds a spider web pattern of concentric wires under tension until the concrete has cured to sufficient strength; then the tension in the wires is transferred to the concrete, releasing the frame which is lifted from the casting.

For more details circle 170 on Enclosed Return Postal Card.

BACK-RIPPERS: A new folder, "Preco Back-Ripper Facts," discusses the basic principle, operating techniques, and the savings made possible by back-ripping. This booklet has been prepared by Preco Incorporated, 6300 E. Slauson Ave., Los Angeles 22, Calif. The folder illustrates the principle of back-rippers, and shows how they do their work while the tractor is backing up—normally a wasted trip. Deadhead time is converted into productive time by ripping the ground as the tractor backs up—the ripper shanks automatically swing out of the way as the tractor moves forward. Dozing work and scraper loading are speeded up, larger loads are obtained and costs are lowered, since the blade is always working in loose material, states the manufacturer.

For more details circle 171 on Enclosed Return Postal Card.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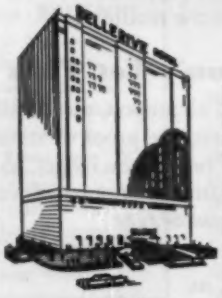

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With The Manufacturers'

D. V. (Joe) WEDEMAN, has been appointed general sales manager of the Utility Division of Highway Trailer Company. He was formerly general sales manager of Maytag East Coast Co., Jacksonville, Florida. Wedeman's appointment is in line with Highway's new program to expand and accelerate the growth of the Utility Division, according to David B. Charnay, chairman of the board of Highway, who made the announcement.

SURVEYORS SERVICE COMPANY, Los Angeles, has been appointed by Wild Heerbrugg Instruments, Inc. as Western distributor for all Wild surveying instruments. Complete stocks will be maintained in Los Angeles, as well as authorized repair services.

B. W. DRUCKENMILLER, president of Penn-Dixie Cement Corporation has announced plans for a major expansion of the company's plant at Clinchfield, Georgia, which will virtually double its capacity. The addition will increase annual capacity of this plant by 1,100,000 barrels to a total of 2,300,000 barrels.

HORTON FICK, formerly vice president of Dorsey Trailer Co., Ela., has joined Highway Trailer Company as special assistant to the chairman of the board. Previous to his connection with the Elba firm, Mr. Fick was engaged in the production of farm machinery in Des Moines, Iowa, where earlier he had also been in the automotive business.

BENJAMIN P. COOPER has been named sales manager for the Firestone International Company, it was announced today by W. D. Waugh, president. Cooper has returned to Akron from the company's plant in Venezuela where he was sales manager. He succeeds Frank B. Norton, who recently was named manager of the United States Trading Company in Monrovia, Liberia.

MINNESOTA MINING & MANUFACTURING Co. vice president for engineering and staff manufacturing C. P. Pesek, has been elected to the 3M board of directors. He has also been elected to the executive committee. Pesek has directed the building program required to keep 3 M facilities abreast of its post-war growth which has seen sales grow from $75 million in 1946 to $376 million last year.

JAMES A. FEENEY AND JOHN H. SMITH have joined the Engineering and Construction Division of American Cyanamid Company, it was announced recently. Mr. Feeney was named project engineer in the project engineering department and Mr. Smith was appointed intermediate general engineer in the instrumentation section of the general engineering department.

WALTER HARCOURT-PALMER has been named as Eastern District Manager for the Koehring Division of Koehring Company, it was announced by Edwin T. Goree, vice-president in charge of sales for the division. The Eastern District includes Maine, New Hampshire, Vermont, Massachusetts, Connecticut, Rhode Island, New Jersey, and parts of New York and Pennsylvania. At the same time, John Melchi was appointed mid-west district representative.

THE MINNEAPOLIS-MOLINE COMPANY has appointed Carl A. Brown of Vickers, Inc., industrial control division, Detroit, to chief hydraulics engineer at Minneapolis-Moline. Brown, a native of Detroit, has broad experience in design, engineering and product development.

D. F. JURGENSEN has been named vice president-general manager of Blaw-Knox Company's Construction Equipment Division. At the same time Wendell F. Simmons was appointed division general sales manager. Mr. Jurgensen, employed in an executive capacity for the last three years for Blaw-Knox, will be responsible for expanding the division's activities.

HERCULES MOTOR CORPORATION, Canton, Ohio has announced two key sales appointments. John E. Scales, former chief engineer and sales manager of Frazier-Wright Company, has been appointed district sales manager for the Pacific Southwestern area; and Robert S. Miller, mechanical engineer, has become manager of oilfield sales.

CARL J. GUSTAFSON has been appointed engineering manager of the gear design department at Mack Trucks, Inc., it was announced recently by I. C. Delta, executive engineer. Gustafson's primary activity will be to handle all new and advanced design geared components.

WHITE MOTOR COMPANY has named H. C. Golden manager of the company's new White Truck Division branch at Jacksonville, Fla. H. J. Nave, executive vice president in charge of White Truck Division announced the appointment of Godden to manage sales, parts and service operations.

DWIGHT E. LEWIS has been promoted to general superintendent of Chain Belt Company's heavy machinery factory operations in Milwaukee. As general superintendent, Lewis will be responsible for factory production in four plants within the firm's construction machinery, conveyor and process equipment divisions.

THE EIMCO CORPORATION, SALT LAKE CITY, has announced two top management appointments. Wayne L. Dowdey, formerly manager of Eimco's southern district, has been appointed general sales manager for the corporation. Paul O. Richter, vice president, has been named general manager of the firm's filter division.

UNITED STATES STEEL CORPORATION'S American Steel and Wire Division has named James E. Brown manager of operations. Mr. Brown has been vice-president and manager of the Division's Cyclone Fence Department. In his new post, he will supervise all American Steel and Wire operations in the Chicago district.

THE YALE & TOWNE MANUFACTURING COMPANY, announces the promotion of Richard F. Brackin, chief gas truck engineer of Yale Materials Handling Division to the post of assistant director of engineering.

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Special report to owners of Traxcavators, D6 and D4 Tractors

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Parts you can trust
Dependable round-the-clock service

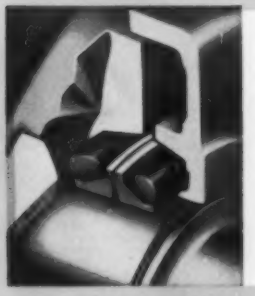
Now available...lifetime lubricated rollers...two-way savings...

ELIMINATE MAINTENANCE GIVE LONGER LIFE

Here's another cost-cutting improvement for Traxcavators and both D6 and D4 Tractors... lifetime lubricated rollers. Now you can eliminate on-the-job shutdowns for greasing. And you get longer life from rims, flanges, internal parts. The payoff... reduced replacement costs, savings in time.

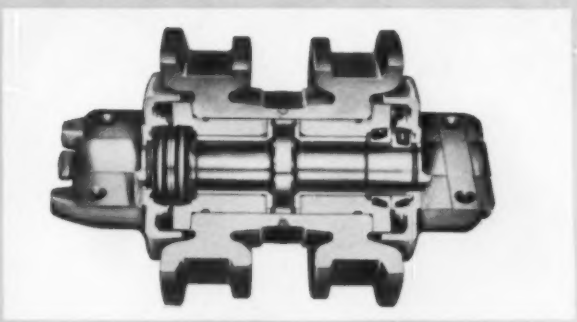
How maintenance is eliminated—the new Cat-built rollers are lubricated when first installed. They are equipped with floating ring seals that keep lubricant in... grit out... for the life of the rollers. Only when rollers are disassembled for rebuilding will relubrication be necessary. And the original metal rings can be reused.

New floating ring seal... only four parts, no springs. The roller seal employs two alloy metal rings and two rubber "O" rings. The metal rings, much harder than the best file steel, have lapped faces, smoother than glass. These faces taper slightly toward the inner edge forming a sealing area at the outer edge. As wear occurs, the sealing area moves gradually inward, maintaining a perfect seal for thousands of hours.



The "O" rings keep constant pressure on the metal rings. Lubricant can't get out. Grit can't get in. There are no springs or diaphragms to weaken, wear or become damaged. The "O" rings are made of special compound to resist oil, heat, cold.

Why do roller parts last longer? Grit is permanently sealed out. Big lubricant reservoirs (with strategically located oil passages) insure ample supply of lubricant to moving parts. Oil instead of grease is used for roller lubricant. Oil dissipates heat faster, circulates more freely than grease. These features assure you of longer shaft and bearing life. Longer bushings with extra-thick flange assures rigid support. Large sleeve bearings provide ample bearing area. Larger diameter, deep-hardened shafts withstand higher shock loads. Beam strength has been increased 63% for D6 shafts; 185% for D4 shafts. Resistance to side thrust is greatly increased in D4 shafts by a 25% wider center flange and 73% more thrust-bearing area.



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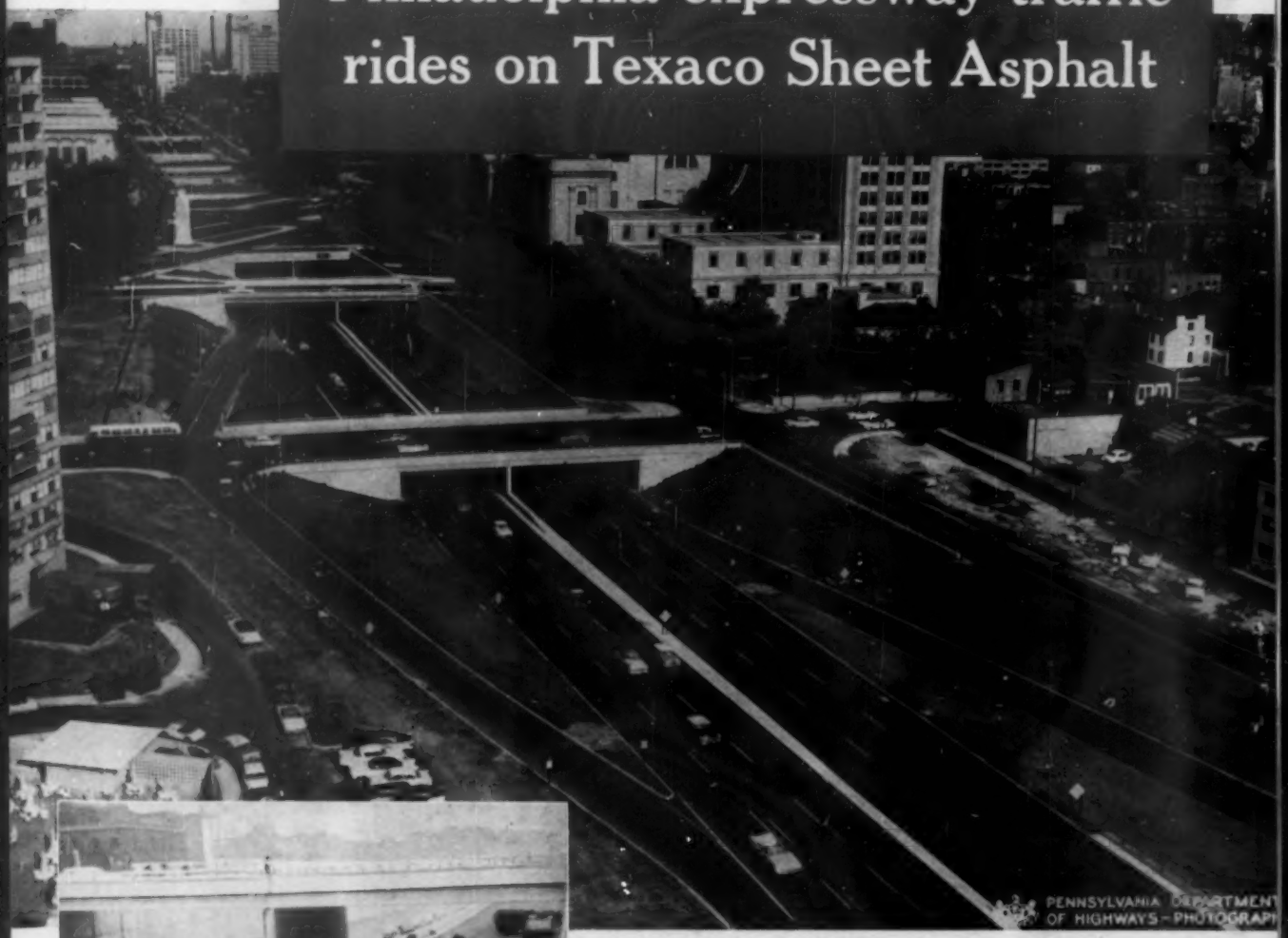

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